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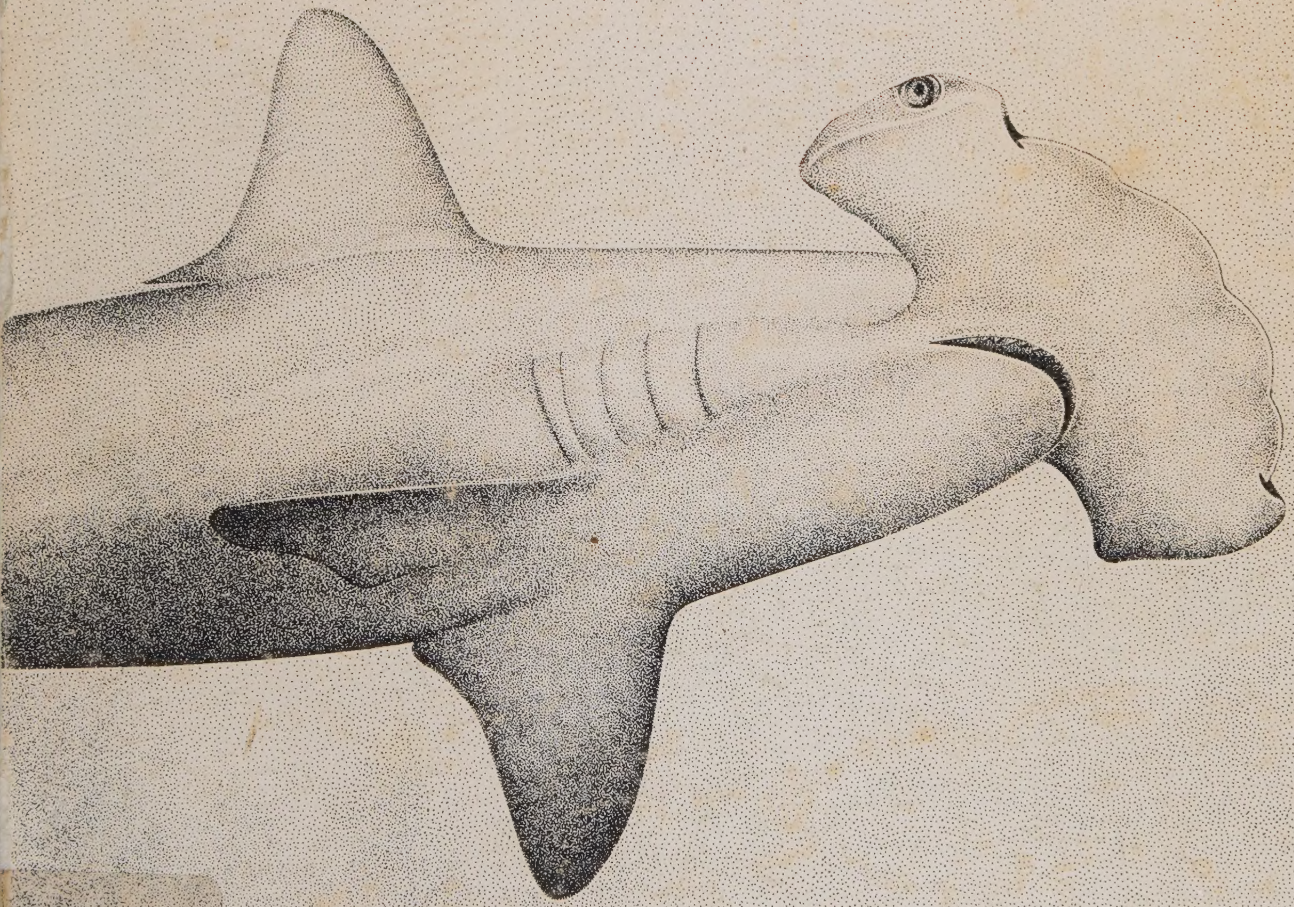
FAO SPECIES CATALOGUE

VOL. 4, PART 2 SHARKS OF THE WORLD

AN ANNOTATED AND ILLUSTRATED CATALOGUE OF SHARK SPECIES KNOWN TO DATE



UNITED NATIONS DEVELOPMENT PROGRAMME
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

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FAO SPECIES CATALOGUE

VOL. 4 SHARKS OF THE WORLD

An Annotated and Illustrated Catalogue
of Shark Species Known to Date

Part 2 - Carcharhiniformes

prepared by

Leonard J.V. Compagno
J.L.B. Smith Institute of Ichthyology
Grahamstown, South Africa

Prepared with support from the
United Nations Development Programme (UNDP)
and the American Elasmobranch Society

UNITED NATIONS DEVELOPMENT PROGRAMME

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

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PREPARATION OF THIS DOCUMENT

The present publication, prepared under the UNDP/FAO Project for the Survey and Identification of World-Marine Fish Resources (GLO/82/001), is the fourth worldwide species catalogue issued within the FAO Fisheries Synopses series.

Work on this catalogue was initiated by the author many years ago with the preparation of a simple list of shark species including only most elementary information such as scientific synonymies, geographical distributions, sizes, etc., preceded by an illustrated key to shark families. However, with the evolvement of a more ambitious format for the series, and parallel to the preparation of the volumes on scombrids and cephalopods, it became necessary to expand the original manuscript very substantially, a task which the author accomplished with his usual enthousiasm and thoroughness, in spite of the difficult conditions under which he had to work during the past years.

The work was facilitated by the author's involvement in several regional sets of FAO Species Identification Sheets for Fishery Purposes, e.g. the Western Central Atlantic, Eastern Central Atlantic and Western Indian Ocean, but the numerous gaps in information on species from the Indo-Pacific region could not have been filled without the author's recent extensive field work in that area, which was made possible thanks to the support of several institutions both within and outside the USA, coordinated by the American Elasmobranch Society.

In the final stages of the work, the author could count on the generous assistance of the J.L.B. Smith Institute of Ichthyology, Grahamstown, South Africa.

The indexes of scientific and common international FAO species names and of local species names were prepared in collaboration with FAO's Fishery Information, Data and Statistics Service.

Illustrations were adapted and redrawn by a wide variety of sources, especially from Okutani (1980).

Illustrators : P. Lastrico (principal illustrator), O. Lidonnici, E. D'Antoni and P.-L. Isola, FAO, Rome.

FAO Family and Species names in French : J.-C. Quéro, Institut Scientifique et Technique des Pêches Maritimes, La Rochelle, France.

Technical Editors : W. Fischer and C.E. Nauen, Fishery Resources and Environment Division, FAO.

ABSTRACT

This is the fourth in the FAO series of worldwide annotated and illustrated catalogues of major groups of organisms that enter marine fisheries. The present volume includes 342 shark species belonging to 8 orders and 31 families. It provides a comprehensive and illustrated key to all orders and families of sharks, with a glossary of technical terms and measurements. Within each family are given individual accounts of species, which include drawings, scientific and vernacular names, information on habitat, biology and fisheries, and a distribution map; for most families there is also a key to genera. The work is fully indexed and there is ample reference to pertinent literature.

Distribution:

Author
FAO Fisheries Department
FAO Regional Fisheries Officers
Regional Fisheries Councils
and Commissions
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9. ORDER CARCHARHINIFORMES - GROUND SHARKS

Order Carcharhiniformes Compagno, 1973, J.Linn.Soc.(Zool.)London, 53, suppl. 1

Synonymy : Order Asterospondyli: Gill, 1893 (in part), Fowler, 1941 (in part), Smith, 1949 (in part). Order Asterospondyli, Suborder Galei: Jordan & Evermann, 1896 (in part). Order Carcharhinida: Glikman, 1967 (in part). Order Carcharhiniformes: Rass & Lindberg, 1971 (in part), Applegate, 1974. "Group" Carcharinoidei: Garman, 1913 (in part). "Group" Catuloidei: Garman, 1913 (in part). Order Euselachii, Suborder Galei: Jordan, 1923 (in part), Whitley, 1940 (in part). Order Euselachii, Suborder Galeoidei: Blot, 1969 (in part). Order Galea, Suborder Carcharhinida: White, 1936, 1937. Suborder Galei: Gill, 1872 (in part). Order Galeiformes, Suborder Carcharhinoidei: Arambourg & Bertin, 1958. Suborder Galeiformes: Lozano Rey, 1928 (in part), Budker & Whitehead, 1971 (in part). Suborder Galeoidea: Romer, 1945, 1966 (in part), Bigelow & Schroeder, 1948 (in part), Norman, 1966 (in part). "Division" Galeoidei: Regan, 1906. Suborder Galeoidei: Engelhardt, 1913. Suborder Galeorhinina: Fowler, 1967b. Order Lamniformes, Suborder Scyliorhinoidei: Berg, 1940, Berg & Svedovidov, 1955, Patterson, 1967. Suborder Lamniformes: Bertin, 1939 (in part). Suborder Lamnina: Matsubara, 1955 (in part). Order Lamnoidea, Suborder Scyliorhinoidea: Schultz & Stern, 1948. Suborder Musteliformes: Bertin, 1939 (in part). Suborder Plagiostomi Asterospondyli: Hasse, 1879 (in part). Suborder Scyliorhinoidei: Lindberg, 1971, Nelson, 1976. Suborder Scylliiformes: Bertin, 1939 (in part). Suborder Scyllioidei: Goodrich, 1909. Suborder Squali: Gill, 1868 (in part).

Diagnostic Features : Trunk cylindrical to slightly compressed or depressed but not raylike. Head conical to depressed and usually not anteriorly expanded, except for the prebranchial head in Sphyrnidae; 5 pairs of gill slits present on sides of head (partly dorsolateral in some Scyliorhinidae), with the last 1 to 3 over pectoral bases; spiracles present in many species, small to large and close behind eyes, or absent; nostrils usually without barbels and nasoral grooves and always without circumnarial grooves, barbels when present developed from anterior nasal flaps rather than from lateral surfaces of flaps, anterior nasal flaps varying from well separated from mouth to overlapping it posteriorly; eyes lateral or dorsolateral on head, with true nictitating lower eyelids; snout varying from very short to moderately long and almost bladelike, but not greatly elongated and not formed as a rostral saw with lateral teeth and barbels; mouth moderately large to very large, arched, and extending behind anterior ends of eyes; labial furrows varying from large and on both jaws to absent; teeth variably differentiated along jaws, but usually without enlarged molariform posterior teeth and with anterior teeth not separated by small intermediate teeth or a gap from the lateral teeth. Two dorsal fins (possibly only one in Pentanchus, family Scyliorhinidae), without spines, the first with origin varying from over the gill slits to behind the pelvic bases; pectoral fins moderate-sized to large but not raylike, without triangular anterior lobes; pelvic fins small to moderately large, with vent continuous with their inner margins; anal fin present; caudal fin with a long dorsal lobe but with ventral lobe varying from long (but considerably shorter than the dorsal lobe) to absent; vertebral axis raised into the dorsal caudal lobe. Intestinal valve of spiral or scroll type.

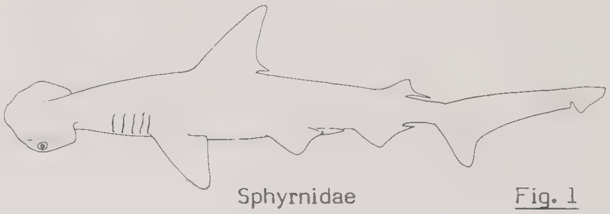
Key to Families :

1a. Head with lateral, bladelike expansions (Figs 1,2a) - Hammerhead sharks .... **Family Sphyrnidae**

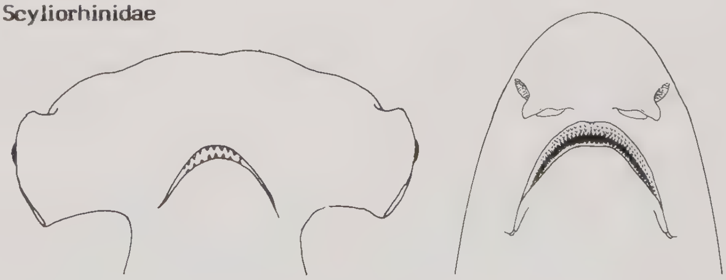
1b. Head normal, without lateral expansions (Fig. 2b)

  2a. First dorsal fin base opposite (Fig. 3) or behind (Fig. 4) pelvic bases - Catsharks .... **Family Scyliorhinidae**

  2b. First dorsal base in front of pelvic bases (Figs 8,10,11,14,15)

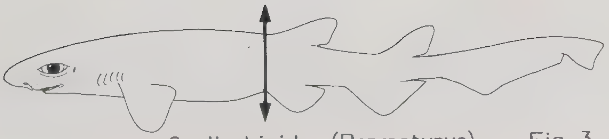


Sphyrnidae Fig. 1

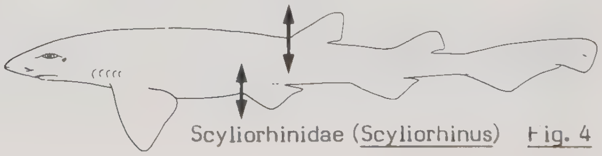


a. Sphyrnidae b. Other families

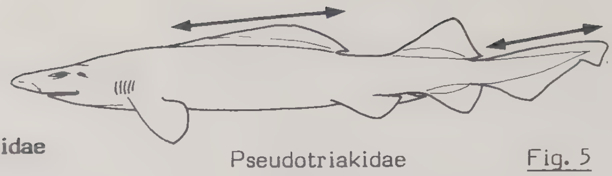
underside of head Fig. 2



Scyliorhinidae (Parmaturus) Fig. 3



Scyliorhinidae (Scyliorhinus) Fig. 4



Pseudotriakidae Fig. 5

3a. First dorsal fin low, elongated, and keel-like, as long as, or slightly longer than the caudal fin (Fig. 5). Over 200 rows of teeth in either jaw - False catsharks .... **Family Pseudotriakidae**

3b. First dorsal fin high, relatively short, and not keel-like, usually shorter than the caudal fin (except in Gogolia of Family Triakidae)

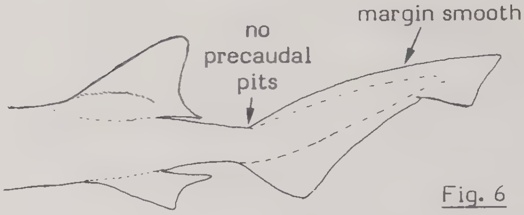
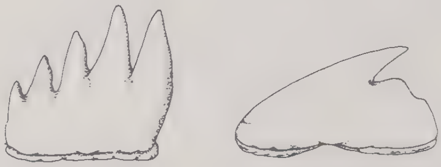


Fig. 6

4a. Precaudal pits absent. Dorsal caudal margin not undulated (Fig. 6)

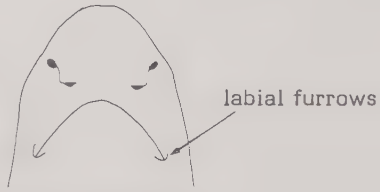
5a. Posterior teeth on dental bands comblike (Fig. 7a). Labial furrows very short or absent, when present confined to mouth corners (Fig. 8) - Finback catsharks .... **Family Proscylliidae**



a. Proscylliidae b. (Triakidae)

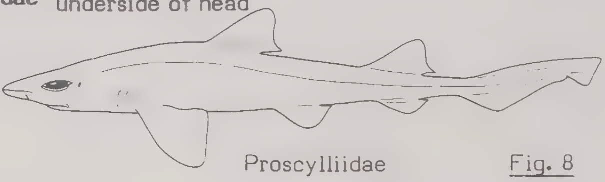
lower posterior tooth Fig. 7

5b. Posterior teeth on dental bands not comblike (Fig. 7b). Labial furrows relatively long with uppers extending partway or all the way anterior to level of symphysis (Fig. 9)



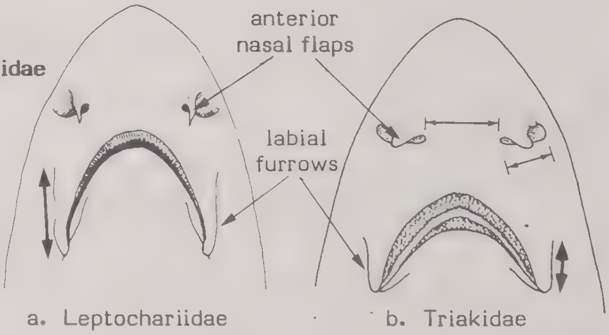
underside of head

6a. Anterior nasal flaps formed as slender barbels. Upper labial furrows extremely long, nearly equal to internarial and over half mouth width (Fig. 9a). Intestinal valve with 14 to 16 turns. No supraorbital crests on cranium (Fig. 10) - Barbeled houndsharks ...... **Family Leptochariidae**



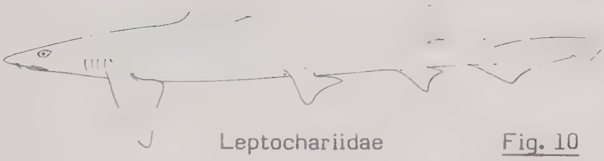
Proscylliidae Fig. 8

6b. Anterior nasal flaps usually not barbel-like (except for Furgaleus). Upper labial furrows shorter, considerably less than internarial and less than half of mouth width (Fig. 9b). Intestinal valve with 4 to 10 turns. Supraorbital crests present on cranium* (Fig. 11) - Houndsharks .... **Family Triakidae**

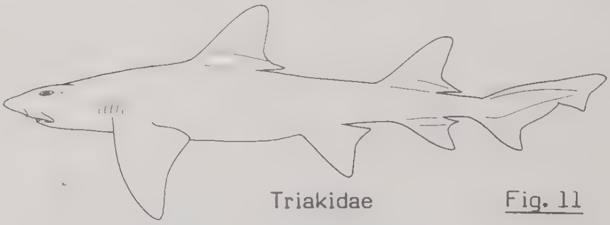


a. Leptochariidae b. Triakidae

underside of head Fig. 9



Leptochariidae Fig. 10



Triakidae Fig. 11

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* Often revealed externally as a hard ridge over each eye, but some species may require dissection to show the crest

4b. Precaudal pits present. Dorsal caudal margin undulated (Fig. 12)

7a. Intestinal valve of spiral type (Fig. 13a) - Fig. 14 - Weasel sharks .... **Family Hemigaleidae**

7b. Intestinal valve of scroll type (Fig. 13b) - Fig. 15 - Requiem sharks .... **Family Carcharhinidae**

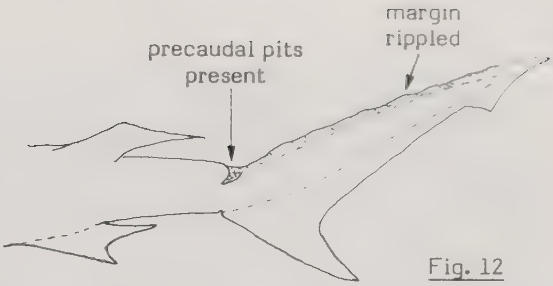
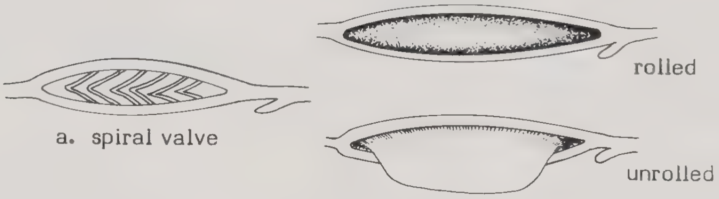


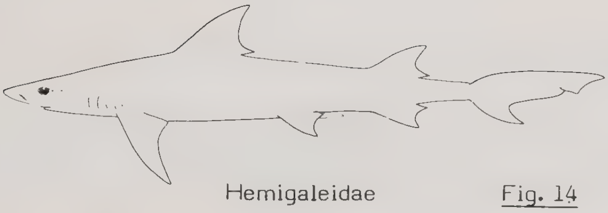
Fig. 12



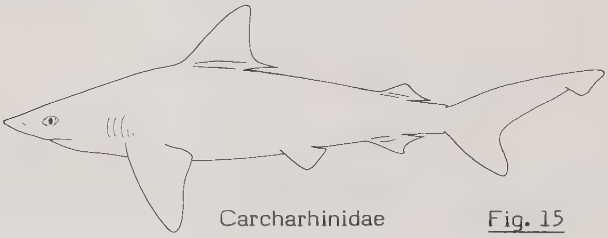
a. spiral valve

b. scroll valve

intestinal valve Fig. 13



Hemigaleidae Fig. 14



Carcharhinidae Fig. 15

9.1 FAMILY SCYLIORHINIDAE Gill, 1862

SCYL

Family Scylliorhinoidae Gill, 1862, Ann.Lyceum Nat.Hist.N.Y., 7(32):393; emended to Family Scyliorhinidae by Jordan & Fowler (1903).

Synonymy : Family Scyllia or Scyllium Müller & Henle, 1838; Family Pentachidae Smith & Radcliffe, 1912; Family Catulidae Garman, 1913; Subfamily Galeinae Fowler, 1934 (Family Scyliorhinidae); Family Halaeluridae White, 1936; Family Atelomycteridae White, 1936; Subfamily Cephaloscylliinae Fowler, 1947 (Family Scyliorhinidae).

FAO Names : En - Catsharks; Fr - Chiens, Holbiches, Roussettes; Sp - Alitanes, Pejegatos, Pintarrojas.

Field Marks : Usually elongated, catlike eyes with nictitating eyelids; nostrils usually without nasoral grooves but, when present, these are broad and shallow; mouth long, arched and reaching past anterior ends of eyes; small cuspidate teeth. Two small, spineless dorsal fins and an anal fin, the first dorsal base over or behind pelvic bases, no precaudal pits, and the caudal fin without a strong ventral lobe or lateral undulations on its dorsal margin.

Diagnostic Features : Head without laterally expanded blades; eyes elongated and fusiform, oval, or slitlike, their length over 1.5 times the height; nictitating eyelids rudimentary; spiracles present and moderately large; anterior nasal flaps variably shaped, but not barbel-like, except for one genus (Poroderma) with a barbel formed from a separate ridge on each anterior nasal flap; internarial width about 0.6 to 1.3 times nostril width; labial furrows absent or very short to very long; teeth small, with acute narrow cusps, often lateral cusplets, and basal ledges, not bladelike, and similar in both jaws; posterior teeth comblike or not; tooth rows 40 to 101/34 to 111. Precaudal pits absent. First dorsal fin small and not keel-like, much shorter than caudal fin; first dorsal base over or behind pelvic bases, its origin either slightly ahead of pelvic origins (Cephalurus) or well behind them; midpoint of first dorsal base always posterior to pelvic origins; pectoral fins with radials confined to bases of fins; ventral caudal lobe absent or very weak; no undulations or ripples in dorsal caudal margin. Neurocranium with or without a supraorbital crest. Vertebral centra with or without strong, wedge-shaped intermedial calcifications. Valvular intestine with a spiral valve of 5 to 21 turns. Many species with variegated colour patterns, some without them. Development usually oviparous, but some species ovoviviparous.

Habitat, Distribution and Biology : This is by far the largest family of sharks, with a broad worldwide geographic range in tropical to cold-temperate and arctic waters; catsharks occur from the intertidal zone to the edges of the continental and insular shelves and down the slopes to depths greater than 2000 m. Catsharks are generally found on or near the bottom in coastal waters inshore and offshore; none are oceanic, although some deepwater species may range a considerable distance off the bottom. Most species are small, less than 80 cm long, and while some may be mature at about 30 cm, a few may reach about 1.6 m length. Catsharks are generally weak swimmers and do not migrate over great distances; this is shown in their geographic distribution, which is often much more localized than that of families with strong swimming species. Some inshore species are nocturnal, sleeping often in groups in rocky crevices in day-time and dispersing to feed at night. Many species show the primitive single oviparity, in which only one fertilized egg enters each oviduct and is deposited on the substrate at a time; the large eggs, encapsulated in tough egg-cases with corner tendrils to anchor them, have most of their embryonic development outside the mother shark and may take nearly a year to produce a hatchling shark. Others possibly in areas of intense egg predation, have multiple oviparity, in which several encased eggs remain in the oviducts for an extended period, during which time the embryos develop to advanced stages before the eggs are laid; such eggs may hatch in less than a month. Still other species have eliminated oviparity altogether and are ovoviviparous, retaining the eggs until the young are ready to be born. Catsharks feed chiefly on invertebrates and small fishes, and are harmless to people. Most species are very poorly known biologically.

Interest to Fisheries : A minority of the species in this family are of importance to fisheries, particularly the spotted catsharks (Scyliorhinus) of the eastern Atlantic, which are much utilized for human food. Some are rather common and regularly taken as a bycatch in the trawl fisheries worldwide, and may be used for fishmeal and oil. Many are deepwater sharks, and are not known to be utilized to any great extent, although they may be a minor component of the catch of large, deep-fishing offshore trawlers. Several inshore species are commonly caught by sportfishers.

Remarks : The present arrangement of this family follows the revision of the Scyliorhinidae by Springer (1979) in most details.

Fowler (1941) placed the dubious genus Caninoa Nardo, 1841, with Thalassokephetes Gistel, 1848 a junior synonym, in the family Scyliorhinidae, on the possibility that it may be a one-dorsaled catshark like Pentanchus profundicolus. I follow Tortonese (1952) in considering Caninoa and its single species C. chiereghini dubious and possibly mythical shark taxa, that are not placeable in modern shark families.

Smith & Radcliffe (1912) proposed a new family for their new genus and species of one dorsal-finned shark, Pentanchus profundicolus, on the assumption that the species was a hexanchoid with five gill openings. However, Regan (1912), Garman (1913), and subsequent writers noted that Pentanchus profundicolus was a scyliorhinid, the genus Pentanchus was close to Apristurus or a senior synonym of it, and that the Pentanchidae was a junior synonym of the Scyliorhinidae.

The following nomina nuda, named by Blainville (1816) and placed in his subgenus Scyliorhinus (Genus Squalus) may refer either to scyliorhinids or orectoloboids: Squalus myops, S. breviculus, S. punctatus, S. punctulatus, S. unicolor, S. variegatus, S. lambarda.

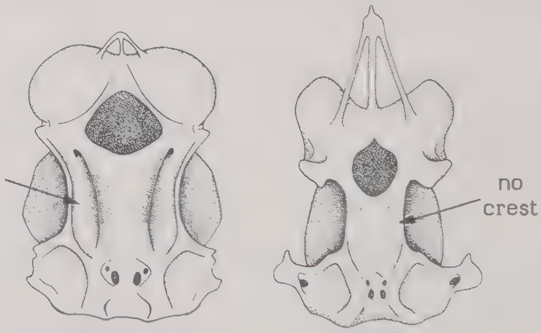
Key to Genera :

1a. Supraorbital crests present on cranium, above eyes (Fig. 1a)

    2a. Second dorsal fin about as large as first (Figs 3 to 5)

        3a. Anterior nasal flaps greatly expanded, reaching mouth; nasoral grooves present (Fig. 2a) .... **Atelomycterus** (Fig. 3)

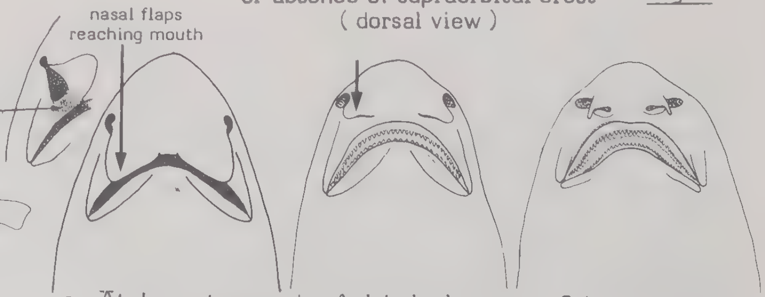
        3b. Anterior nasal flaps not expanded and not reaching mouth; nasoral grooves absent (Fig. 2b,c)



a. (Cephaloscyllium) b. (Galeus)

crania showing presence or absence of supraorbital crest (dorsal view)

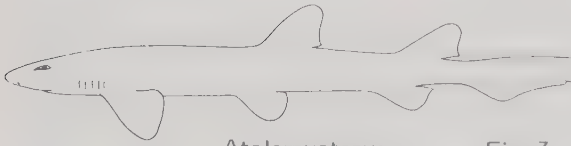
Fig. 1



a. Atelomycterus b. Aulohalaelurus c. Schroederichthys

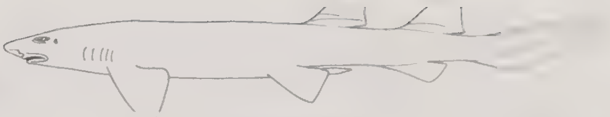
underside of head

Fig. 2



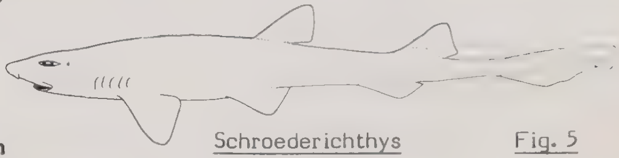
Atelomycterus Fig. 3

4a. Labial furrows very long, uppers reaching level of upper symphysis (Fig. 2b) .. **Aulohalaelurus** (Fig. 4)



Aulohalaelurus Fig. 4

4b. Labial furrows shorter, uppers not reaching level of upper symphysis (Fig. 2c) .... **Schroederichthys** (Fig. 5)



Schroederichthys Fig. 5

2b. Second dorsal fin considerably smaller than first (Figs 7 to 9)

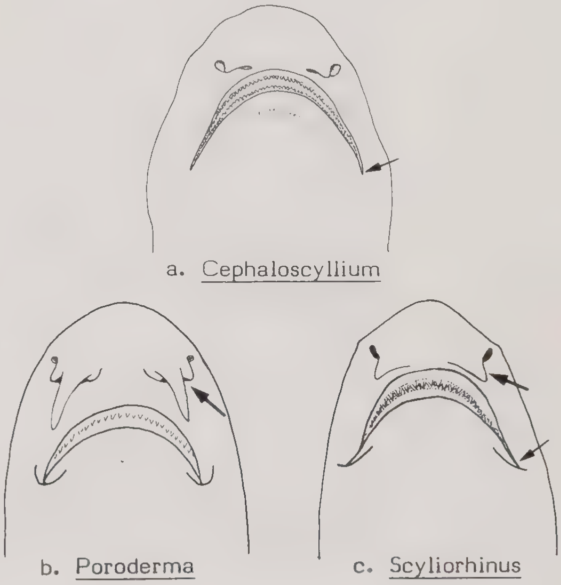
5a. Labial furrows absent or rudimentary (Fig. 6a)..... **Cephaloscyllium** (Fig. 7)

5b. Labial furrows present on one or both jaws (Fig. 6b,c)

6a. Anterior nasal flaps trilobate, with prominent barbels. Short upper labial furrows present in addition to lowers (Fig. 6b)............. **Poroderma** (Fig. 8)

6b. Anterior nasal flaps entire, without barbels or at most medial projections. Lower labial furrows present, uppers absent (Fig. 6c) .. **Scyliorhinus** (Fig. 9)

1b. Supraorbital crests absent from cranium (Fig. 1b)

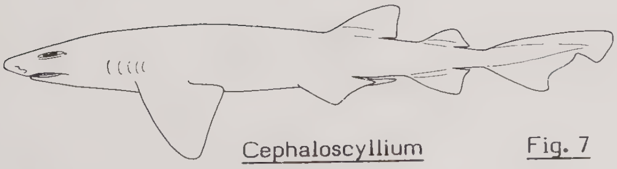


a. Cephaloscyllium

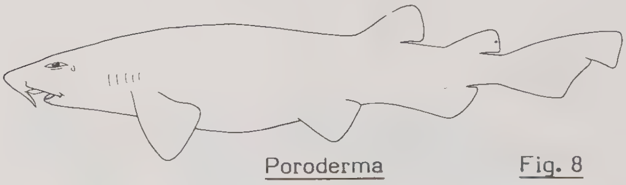
b. Poroderma

c. Scyliorhinus

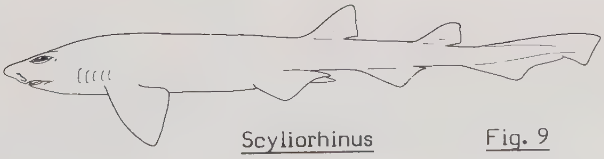
underside of head Fig. 6



Cephaloscyllium Fig. 7



Poroderma Fig. 8



Scyliorhinus Fig. 9

7a. Head broadly flattened and spatulate, snout elongated and usually longer than mouth width. Labial furrows very long, uppers reaching upper symphysis (Fig. 10a)

8a. One dorsal fin (Fig. 11) .... **Pentanchus**

8b. Two dorsal fins (Fig. 12) .... **Apristurus**

7b. Head moderately or little-flattened, not spatulate, snout equal or usually shorter than mouth width. Labial furrows shorter or absent, when present not reaching upper symphysis (Fig. 10b)

9a. Dorsal caudal margin, and sometimes preventral margin, with a crest of enlarged denticles (Fig. 13a)

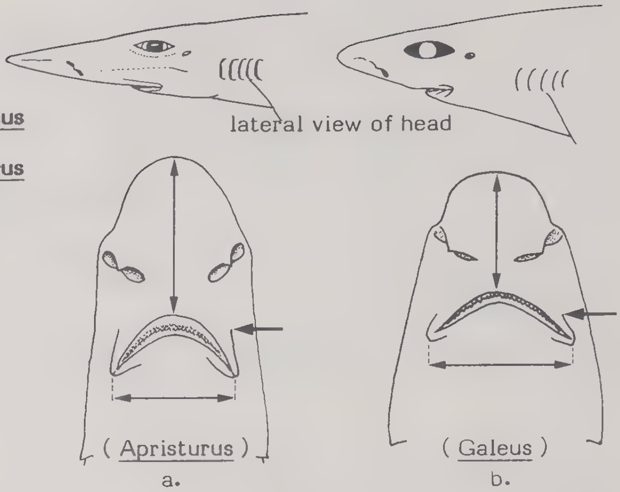
10a. Pectoral fins relatively large, width of their posterior margins usually larger than mouth width. Subocular ridges obsolete or nearly so, eye lateral. Body firm. Colour pattern of blotches and spots often present (Fig. 14).... **Galeus**

10b. Pectoral fins relatively small, width of their posterior margins usually smaller than mouth width. Subocular ridges well-developed, eyes dorsolateral. Body soft. Colour plain, no pattern (Fig. 15) .... **Parmaturus**

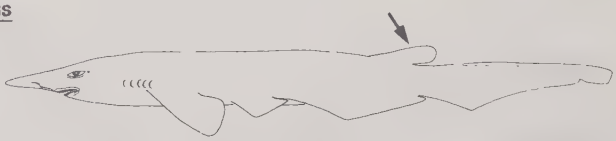
9b. No caudal crests of denticles (Fig. 13b)

11a. Head and especially branchial region greatly enlarged, giving adults a tadpole-shape. Origin of first dorsal fin slightly anterior to pelvic origins (Fig. 16).. **Cephalurus**

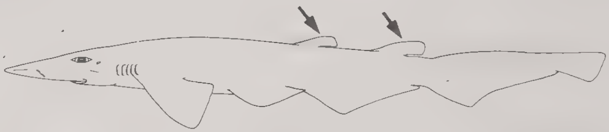
11b. Head not greatly enlarged, adults not tadpole-shaped. Origin of first dorsal fin posterior to pelvic origins



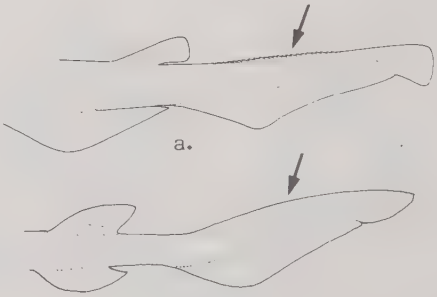
underside of head Fig. 10



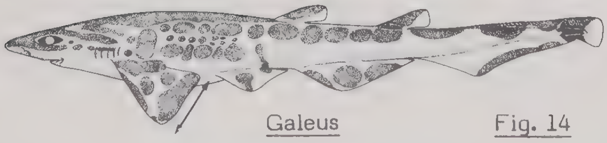
Pentanchus Fig. 11



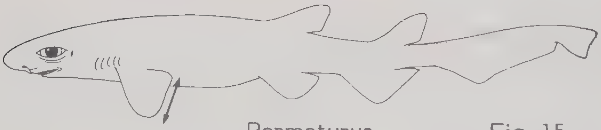
Apristurus Fig. 12



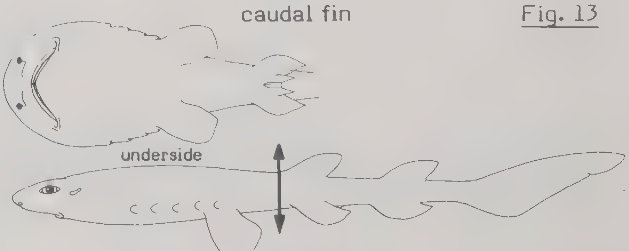
caudal fin Fig. 13



Galeus Fig. 14



Parmaturus Fig. 15



Cephalurus Fig. 16

12a. Anterior nasal flaps greatly enlarged, overlapping mouth; nasoral grooves present (Fig. 17a) .... **Haploblepharus** (Fig. 18)

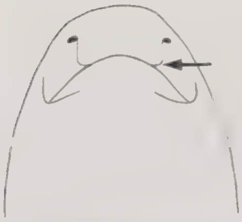
12b. Anterior nasal flaps not enlarged and not overlapping mouth; no nasoral grooves (Fig. 17b,c)

13a. Head very broad. Labial furrows absent. Small black dots on underside of head (Fig. 17b) .... **Holohalaelurus** (Fig. 19)

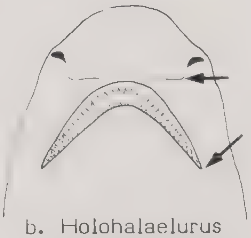
13b. Head narrower. Labial furrows usually present. No black dots, or larger dark spots, on underside of head (Fig. 17c)

14a. Adult males without inner margins of pelvic fins fused over claspers. Either no colour pattern or, if pattern is present, gill slits elevated above level of mouth and snout pointed .... **Halaelurus** (Fig. 20)

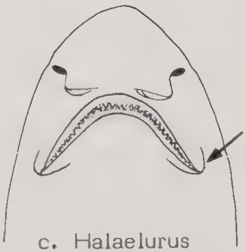
14b. Adult males with inner margins of pelvic fins fused over claspers, forming an "apron". A colour pattern of spots present, but gill slits not elevated and snout rounded (Fig. 21) .... **Asymbolus**



a. Haploblepharus

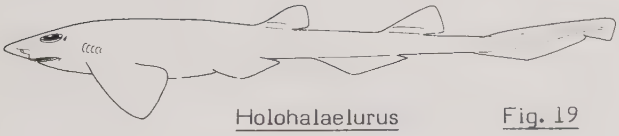


b. Holohalaelurus

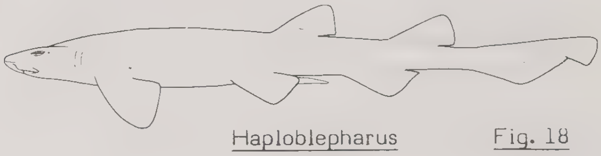


c. Halaelurus

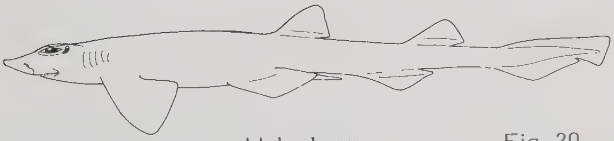
underside of head Fig. 17



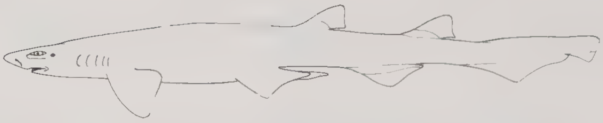
Holohalaelurus Fig. 19



Haploblepharus Fig. 18



Halaelurus Fig. 20



Asymbolus Fig. 21

Apristurus Garman, 1913

SCYL Aprist

Genus : Apristurus Garman, 1913, Mem.Mus.Comp.Zool.Harv.Coll., 36:96.

Type Species : Scylliorhinus indicus Brauer, 1906, by original designation.

Synonymy : Genus Pentanchus Smith & Radcliffe, 1912 (see discussion under that genus); Genus Apristurius Schultze, Kuekenthal & Heider, 1926 (error); Subgenus Parapristurus Fowler, 1934 (Genus Pentanchus); Subgenus Compagnoia Springer, 1979 (Genus Parmaturus).

Field Marks : Scyliorhinids with "the Apristurus look" - Long laterally expanded snout and head, enlarged nostrils with reduced anterior nasal flaps, very long labial furrows, small rear-sited, spineless dorsal fins, very large, elongated anal fin separated from elongated caudal by a notch only, and uniform coloration.

Diagnostic Features: Body not tadpole-shaped, stocky and more or less compressed, increasing in height up to the pectoral and trunk region and tapering posteriorly; body very soft and flabby, with thin skin and weakly calcified dermal denticles; stomach not inflatable; tail short, length from vent to lower caudal origin about 2/5 to 3/5 of snout-vent length. Head greatly depressed, pointed and wedge-shaped in lateral view, rather elongated, but usually slightly less than 1/4 of total length in adults; snout elongated, about equal to mouth width or greater, greatly flattened, narrow and pointed in lateral view; snout expanded laterally, narrowly spade-shaped to broadly spatulate and usually more or less bell-shaped in dorsoventral view; ampullal pores enlarged and prominent on snout; nostrils more or less enlarged, with incurrent and excurrent apertures broadly open to exterior; anterior nasal flaps reduced to angular lobes, without barbels, widely separate from each other and falling far anterior to mouth; internarial space 0.8 to 1.7 times the nostril width; no nasoral grooves; eyes dorsolateral on head, broad subocular ridges present below eyes; mouth angular or broadly arched, with lower symphysis well behind upper so that upper teeth are exposed in ventral view; labial furrows present along both upper and lower jaws, these long and reaching nearly or quite to level of upper symphysis of mouth; branchial region not greatly enlarged, distance from spiracles to fifth gill slits less than half head length; gill slits lateral on head. Two dorsal fins present, equal-sized or with the second dorsal larger than the first; origin of first dorsal varying from over the pelvic midbases to over the pelvic free rear tips; origin of second dorsal about over or slightly behind the anal midbase, anal fin enlarged and more or less elongated, larger than pelvic and dorsal fins, base length at least twice second dorsal base; origin of anal just behind pelvic bases, and insertion separated from lower caudal origin by a narrow notch; pectoral fins variable in size, their width less to greater than mouth width; inner margins of pelvic fins not fused over claspers in adult males; claspers short, thick, and distally pointed, not extending more than 2/3 of their lengths behind the pelvic fin tips and sometimes not extending past their tips. Caudal fin more or less elongated, over a fifth and often over a fourth of total length. A crest of enlarged denticles absent or variably developed on the dorsal caudal margin; supraorbital crests absent from cranium. No colour pattern, uniformly jet black, brownish-black, brown, pinkish or whitish.

Remarks: This is one of the largest and perhaps least known of shark genera, having some 25 described species and several unnamed taxa. Springer (1966, 1979) recently revised the genus while Nakaya (1975) reviewed the Japanese species. Despite their efforts, several species are of uncertain validity, with over a third of the species known from the holotypes only, at least four species having the holotypes lost, and less than a third of the species known from modest to good series of specimens. Judging from the frequency that new species are discovered, the wide geographic range of the genus, and the paucity of knowledge of slope faunas in many areas of the world, this may eventually become the largest genus of sharks.

The present treatment of *Apristurus* contains much new data and differs from Springer's (1979) revision in a number of ways; but most importantly it includes three species placed by him in separate genera. *A. spongiceps* was placed by Springer in the genus *Parapristurus*, raised in rank from a subgenus proposed by Fowler (1934). It was primarily distinguished from *Apristurus* by its pleated gills and throat, but although no *Apristurus* have pleats and grooves on their gills, several have them on their throats, including *A. manis*, *A. riveri* (photo in Springer, 1979, fig. 18), and a possibly undescribed Galapagos-Peruvian species close to *A. stenseni*. Also, other species of *Apristurus* including *A. kampae*, *A. manis*, and *A. microps* approach *A. spongiceps* in its unusually stocky body and high rounded fins. The writer prefers to retain *Parapristurus* in *Apristurus*, and thinks it may be worthy of subgeneric ranking at best.

Springer's earlier (1966) revision of western Atlantic *Apristurus* included a species with a crest of enlarged denticles on its caudal fin, which he termed *A. profundorum*. However, he later (Springer, 1979) noted that two species were confused under this name, the true *profundorum* without a crest and a new species with a crest. This latter he placed in *Parmaturus* rather than *Apristurus*, as *P. manis*, along with a second new species, *P. stenseni*, in the new subgenus *Compagnoia*.

Compagnoia was an anomaly within *Parmaturus* because although it supposedly agreed with that genus and differed from *Apristurus* in its supracaudal crest, its members otherwise closely resembled *Apristurus* species and not typical *Parmaturus* (such as *P. pilosus* and *P. xaniurus*) in their long, laterally expanded snouts and heads, enlarged nostrils, long labial furrows, compressed bodies, long low anal fins separated by a notch from the caudal fin, and long narrow caudal fins. Investigation of the caudal fins of *Apristurus* species by the writer showed that caudal crests are not confined to *manis* and *stenseni*, but are variably developed in *A. canutus*, *A. investigatoris*, *A. microps*, *A. parvipinnis*, the true *A. profundorum*, and at least two apparently undescribed species. Rather than placing these species in an increasingly heterogeneous *Parmaturus*, I prefer to transfer the subgenus *Compagnoia* to *Apristurus*, and place *manis* and *stenseni* in that genus. Those *Apristurus* with caudal crests are sufficiently heterogeneous so as not to warrant their inclusion in the subgenus *Compagnoia* as distinct from all other *Apristurus*. *A. microps* and *A. profundorum* are isolated in the genus and not particularly close to either *A. manis* or *A. stenseni*, *A. canutus* and *A. parvipinnis* are closest to *A. platyrhynchus* and *A. verweyi*, while *A. investigatoris* is apparently close to *A. indicus*. *A. stenseni* appears to be not particularly close to *A. manis* but forms a species groups or superspecies with *A. riveri*, *A. kampae*, a possibly new Galapagos-Peruvian species, a whitish species from the eastern Atlantic (possibly *A. atlanticus*), and a possibly new dark western Atlantic species. If the subgenus *Compagnoia* is recognized it would be best utilized for its type alone, the distinctive and isolated *A. manis*.

Key to Species:

1a. First dorsal fin much smaller than second, about half its area or less, with its origin
usually behind pelvic insertions but over last fourth of pelvic bases in some species

2a. Origin of first dorsal somewhat in front of pelvic insertions

3a. Nostrils small, internarial space 1.5 times their width or more. Mouth very long, expanded in front of eyes. Gill slits enlarged, the widest nearly equal to length of eyes in adults .... A. riveri

3b. Nostrils larger, internarial space about equal to their width. Mouth short, not expanded in front of eyes. Gill slits short, the widest much less than eye length

4a. Prenarial snout angular. Gill septa with medial projections. Distance between pectoral and pelvic bases long, at least length of prespiracular, rear tips of pectoral fins far in front of pelvic origins .... A. sinensis

4b. Prenarial snout broadly rounded. Gill septa incised, without medial projections. Distance between pectoral and pelvic bases extremely short, less than preoral snout, rear tips of pectoral fins about opposite or just in front of pelvic origins .... A. herklotsi

2b. Origin of first dorsal behind pelvic insertions

5a. Colour white or reddish white. Snout relatively narrow and pointed. Mouth extending well in front of eyes. Eyes very small, about equal to longest gill slit .... A. sibogae

5b. Colour black, brown or grey. Snout broad and rounded. Mouth mostly under eyes. Eyes larger, their length much greater than widest gill slit

6a. Distance between pectoral and pelvic bases short, 6 to 9% of total length. Anal fin base 2.5 to 3 times fin height .... A. canutus

6b. Distance between pectoral and pelvic bases longer, 10 to 14% of total length. Anal base 4 to 5 times fin height

7a. Anal base shorter, 16 to 18% of total length. Dorsal caudal margin with a fairly prominent crest of enlarged denticles .... A. parvipinnis

7b. Anal base longer, 18 to 19% of total length. Dorsal caudal margin without a crest of denticles

8a. Pelvic fins relatively high and broadly rounded. Interdorsal space slightly less or greater than preorbital snout ...... A. platyrhynchus

8b. Pelvic fins low and angular. Interdorsal space about 2/3 of preorbital snout .... A. verweyi

1b. First dorsal fin nearly or quite as large as second, two-thirds to equal its area, with its origin usually about opposite pelvic midbases but more posterior and about opposite last third or fourth of pelvic bases in a few species

9a. Nostrils rather narrow, internarial space at least 1.5 times the nostril width. Gill slits very wide, greater than eye length in adults

10a. Fins with prominent white edges. Anal fin very high and broadly rounded, its length about twice its height. Distance between pectoral and pelvic bases long, greater than preorbital snout. Dorsal crest of denticles absent from caudal fin .... A. kampae

10b. Fins without white edges. Anal fin low and subangular, its length over three times its height. Distance between pectoral and pelvic bases short, much less than preorbital snout. A prominent dorsal crest of denticles on caudal fin .... A. stenseni

9b. Nostrils rather broad, internarial space 1.3 times the nostril width or less, usually about equal to it. Gill slits narrower, less than eye length in adults

11a. Gill slits covered with grooves and pleats that extend to the epibranchial area and to the entire throat region behind the jaws .... A. spongiceps

11b. Gill slits not covered with grooves and pleats, these, where present, confined to throat

12a. Eye very large, horizontal diameter more than 4.2% of total length .... **A. atlanticus**

12b. Eye smaller, horizontal diameter generally less than 4% of total length and often about 3% of total length

13a. Interdorsal space very long, about equal to prespiracular head .... **A. saldanha**

13b. Interdorsal space shorter, less than prespiracular head

14a. Snout extremely long, preoral length about 12% of total length .... **A. longicephalus**

14b. Snout shorter, preoral length about 7 to 11% of total length

15a. Interdorsal space equal to, or slightly less than first dorsal base. Pectoral inner margins very short, about a third of pectoral bases .... **A. microps**

15b. Interdorsal space greater than first dorsal base. Pectoral inner margins longer, half to about equal to pectoral bases

16a. Gill septa with prominent medial projections .... **A. maderensis**

16b. Gill septa with no, or at most only weak, projections

17a. First dorsal origin over last fourth of pelvic bases .... **A. macrorhynchus**

17b. First dorsal origin over pelvic midbases

18a. Distance between pectoral and pelvic bases greater than prebranchial head .... **A. japonicus**

18b. Distance between pectoral and pelvic bases subequal or less than prebranchial head

19a. Distance between pectoral and pelvic bases greater than prespiracular head

20a. Interdorsal space about equal to preoral snout .... **A. brunneus**

20b. Interdorsal space greater than preoral snout .... **A. nasutus**

19b. Distance between pectoral and pelvic bases less than prespiracular head

21a. Caudal fin without a crest of enlarged denticles

22a. First dorsal lower than the second and extending anteriorly as a long, low ridge. Mouth very short, with dental bands hardly expanded .... **A. indicus**

22b. First dorsal as high as second and not extending anteriorly as a low ridge. Mouth longer, with dental bands somewhat expanded .... **A. laurussoni**

21b. Caudal fin with a crest of enlarged denticles

23a. Mouth very short and relatively small, not expanded in front of eyes and with dental bands not greatly enlarged. First dorsal about two-thirds of area of second, extending anteriorly as a long, low ridge to nearly over pelvic origins .... **A. investigatoris**

23b. Mouth long and large, expanded in front of eyes and with dental bands enlarged. First dorsal as large as second, not extending anteriorly as a ridge and originating about over pelvic midbases

24a. Body stout and strongly tapering to head. Lateral trunk denticles very sparse on body, not overlapping. Nostrils with circular, broad incurrent and excurrent apertures. Anal fin broadly rounded, caudal fin very narrow. Tips of dorsal fins whitish .... A. manis

24b. Body slender and not strongly tapering to head. Lateral trunk denticles more close-set on body, nearly overlapping. Nostrils with elongate-oval, narrow incurrent and excurrent apertures. Anal fin subangular, caudal fin broader. Tips of dorsal fins plain .... A. profundorum

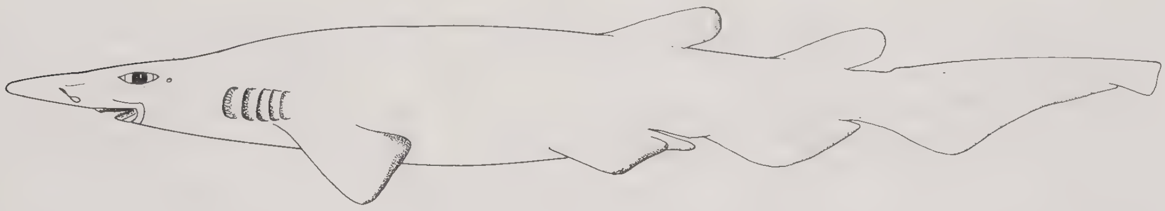
Apristurus atlanticus (Koefoed, 1932)

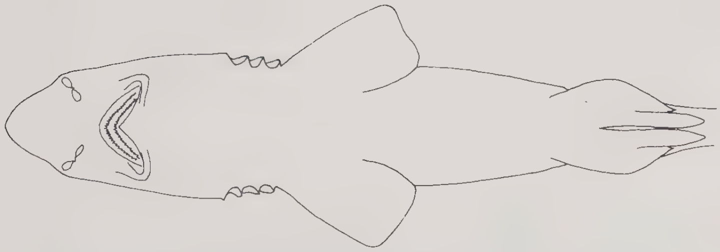
SCYL Aprist 1

Scylliorhinus atlanticus Koefoed, 1927, Rep.Sci.Res."Michael Sars"N.Atl.deep-sea Exped., 1910, 4(1):18, pl. 3, fig. 3. Holotype: Zoological Museum, Oslo, Norway, ZMO, about 250 mm total length. Type Locality: 28°08'N, 13°35'W, 1365 m depth off Canary Islands.

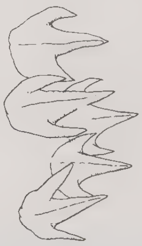
Synonymy : None.

FAO Names : En - Atlantic ghost catshark; Fr - Holbiche atlantique; Sp - Pejegato atlántico.



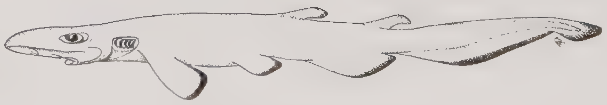


partial ventral view



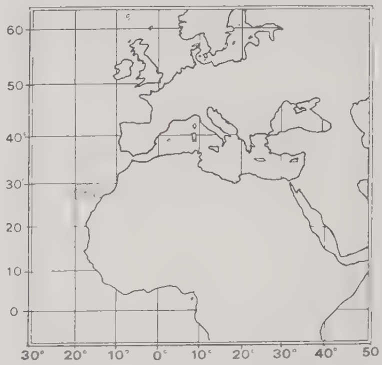
dermal denticles

Field Marks : An Apristurus with unusually large eyes, 5% of total length.



holotype, after Koefoed

Diagnostic Features : Body rather slender, trunk slightly tapering toward head. Snout moderately long, and broad, preoral snout about 9% of total length; gill slits of moderate size, about half the eye length; gill septa incised but not pleated, without projecting medial lobes; eyes rather large, about 5% of total length; mouth probably short and broadly arched, with dental bands moderately expanded and with lower ones falling well behind uppers; mouth and labial furrows about under eyes; labial folds possibly little enlarged, with lower folds diagonal to body axis; mouth and teeth enlarged in males. Interdorsal space about 1.6 times first dorsal base, slightly less than preorbital snout; first dorsal fin slightly smaller in area than second, bases about equally long; origin of first dorsal about opposite last fourth of pelvic bases; second dorsal insertion about opposite anal insertion; pectoral fins rather small, anterior margins about 12% of total length; inner margins long, nearly length of pectoral bases; interspace between pectoral and pelvic bases short, slightly less than preorbital length and about 10% of total length; pelvic fins moderately high and angular; anal fin short, fairly low, and angular, about 3.5 times as long as high, its base about equal to prespiracular space and 14% of total length; caudal fin fairly long and narrow, presence or absence of supracaudal crest uncertain (see remarks). Lateral trunk denticles of body may have elevated crowns, giving the skin a feltlike or fuzzy texture. Colour brown, with conspicuous dark posterior margins on precaudal fin and dark gill septa. Adult size uncertain.



Geographical Distribution : Known with certainty only from the type locality.

Habitat and Biology : A poorly known deepwater catshark, trawled from yellow mud bottom of the Atlantic continental slope.

Size : Maximum known 25+ cm.

Interest to Fisheries : None.

Literature : Koefoed (1932); Springer (1979).

Remarks : This species is recognized following Springer (1979), but its validity needs to be confirmed by collection of more material. The writer examined several specimens of a small Apristurus in the Institüt für Seefischerei, Hamburg ichthyological collections, from very deep water (usually 1500 m or more) on offshore banks in the northeastern Atlantic north of the British Isles. Their most striking characters are their lead-grey coloration, elevated, Deania-like lateral trunk denticles that give their skin a fuzzy texture, relatively large eyes (nearly 4% of total length in adults), slender bodies, relatively narrow snouts, small nostrils with the internarial at least 1.5 times the nostril width, large, equal-sized dorsal fins with a short interdorsal space hardly longer than the first dorsal base, and relatively small size (adults being between 40 and 50 cm long. These may belong to the present species or a new one. If distinct, A. atlanticus apparently differs from them in having a more posterior first dorsal fin origin, darker coloration, and mouth not expanded anterior to eyes.

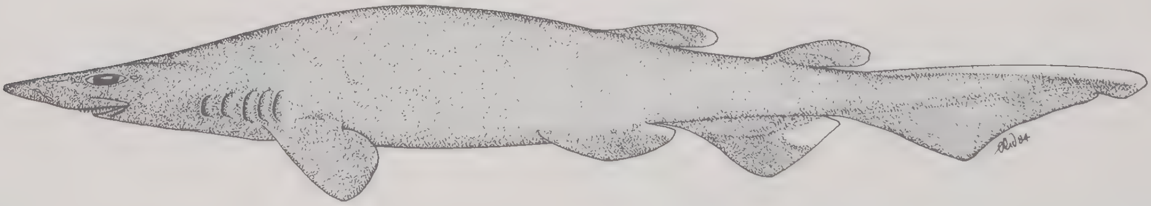
Apristurus brunneus (Gilbert, 1892)

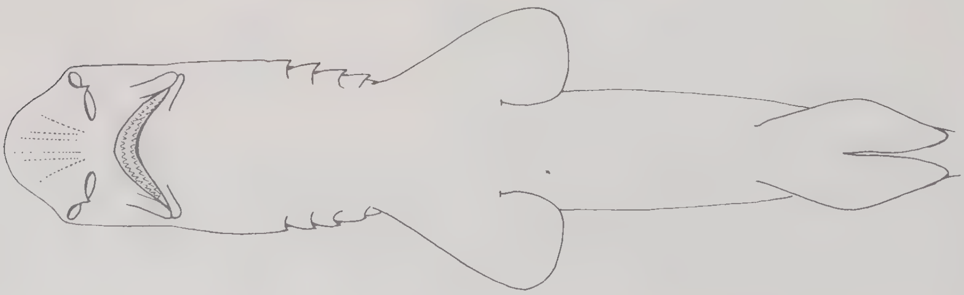
SCYL Aprist 2

Catulus brunneus Gilbert, 1892, Proc.U.S.Nat.Mus., 14(880):542. Holotype: U.S. National Museum of Natural History, USNM, 51708, 500 mm, gravid female. Type Locality: 32°49'N, 117°29'W, 556 m depth off La Jolla, California.

Synonymy : None.

FAO Names : En - Brown catshark; Fr - Holbiche brune; Sp - Pejegato marrón.



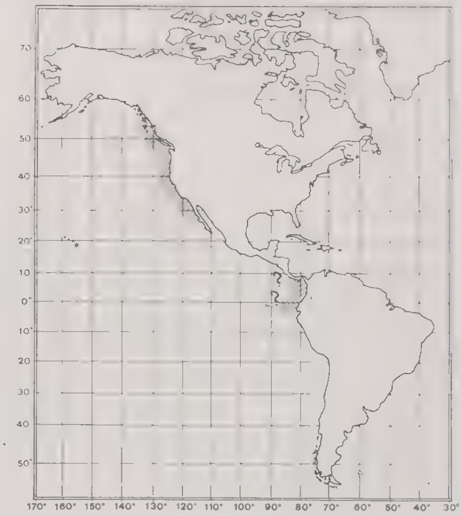


partial ventral view

Field Marks : See diagnostic features and key to species.

Diagnostic Features : Body relatively slender, trunk slightly tapering toward head. Snout moderately long, rather broad, and bell-shaped, preoral snout about 7% of total length; gill slits moderately large, the longest about equal to eye length; gill septa more or less incised, not pleated and without projecting medial lobes; eyes rather small in adults, about 2.5% of total length; nostrils broad, their width about equal to internarial space; incurrent and excurrent apertures moderately large and transversely oval, anterior nasal flaps fairly long; mouth moderately long, not greatly enlarged, and broadly arched, with dental bands slightly expanded and with lower ones falling just behind uppers; mouth and labial furrows under eyes; labial folds not enlarged, with lowers diagonal to body axis; mouth and teeth not greatly enlarged in males. Interdorsal space equal or slightly greater than first dorsal base, slightly less than preorbital snout; first dorsal fin about as large as second, bases about equally long; origin of first dorsal slightly anterior to pelvic midbases; second dorsal insertion in front of anal insertion; pectoral fins rather small, anterior margins about 12% of total length; inner margins long, nearly length of pectoral bases; interspace between pectoral and pelvic bases moderately long, about equal to prebranchial length and about 16% of total length in adults; pelvic fins fairly high and broadly rounded; anal fin fairly short, high, and angular, slightly more than 2.5 times as long as high, its base slightly greater than prespiracular space and 13% of total length in adults; caudal fin rather broad, without a crest of enlarged denticles on dorsal margin. Lateral trunk denticles with crowns somewhat elevated, body surface with a feltlike or fuzzy texture. Colour dark brown, with conspicuous light posterior margins on fins. Adults moderately large, 42 to 69 cm.

Geographical Distribution : Eastern Pacific: British Columbia, Canada, to northern Baja California, Mexico, probably south to Panama, Ecuador and Peru.



Habitat and Biology : A little-known, common deepwater bottom shark from the outer continental shelf and upper slope from 33 to 950 m depth, also well off the bottom.

Oviparous, laying a single egg per oviduct at a time; egg cases about 5 cm long and 2.5 wide, with long tendrils. Incubation period of eggs possibly about 1 year. In Canadian waters, females carry egg cases from February to August.

Eats primarily small true shrimps, but also euphausiid shrimps, squids, and small fishes.

Attempts have been made to keep this small harmless shark in captivity, without notable success (up to two weeks).

Size : Maximum 68 cm, males adolescent at about 50 cm, adults males 49 to 57 cm, adult females 42 to 49+ cm, size of young at hatching about 7 cm.

Interest to Fisheries : Commonly taken in deeper bottom trawl hauls, but not utilized at present.

Literature : Cox (1963); Kato, Springer & Wagner (1967); Miller & Lea (1972); Hart (1973); Jones & Geen (1977); Springer (1979).

Remarks : Until relatively recently all Apristurus caught north of Baja California in the eastern North Pacific were referred to this species. Apart from A. kampae and a possibly new species of heavy-bodied, kampae-like Apristurus from off California, the rather large number of specimens of Apristurus brunneus in the collections of the California Academy of Sciences and elsewhere in the western North Pacific may represent more than one species of brunneus-like catsharks. The writer has examined the holotype of A. brunneus and compared it to available 'brunneus' material, and suspects than an additional species, with smaller, flat, smooth denticles, a much longer, lower anal and caudal fin, lower pelvic fins, smaller gills, narrower snout, larger pectoral fins, and less expanded dental bands is present in this material. Whether this is identical to A. nasutus or some other species, or is new, remains to be seen.

The above illustration is based on drawings of the holotype of this species by the writer.

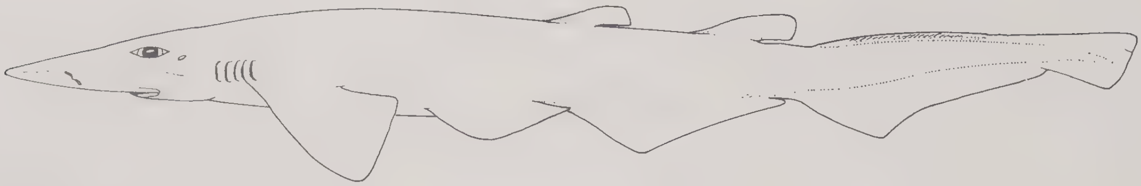
Apristurus canutus Springer & Heemstra, 1979

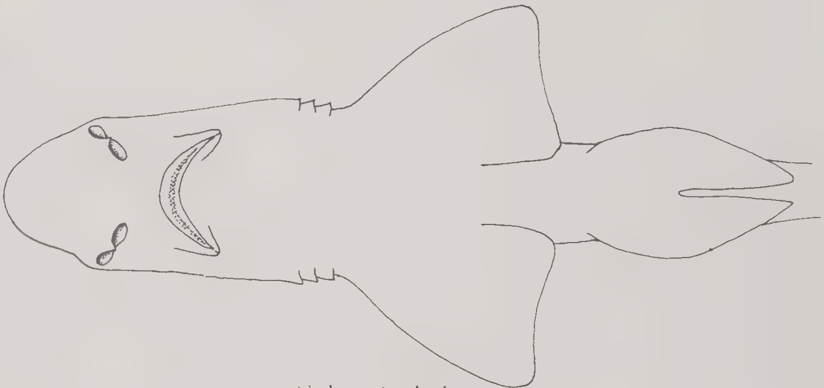
SCYL Aprist 3

Apristurus canutus Springer & Heemstra, in Springer, 1979, NOAA Tech.Rep.NMFS Circ., (422):16, figs 10 to 13. Holotype: U.S. National Museum of Natural History, USNM 206176, 455 mm adult female. Type Locality: 18°18'N, 63°23'W, Leeward Islands near Anguilla in 687 m depth, western North Atlantic.

Synonymy : None.

FAO Names : En - Hoary catshark; Fr - Holbiche grise; Sp - Pejegato cano.



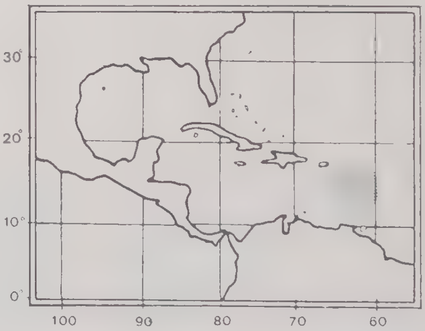


partial ventral view

Field Marks : One of several Apristurus with first dorsal fin half the size of second. For other characters see diagnostic features and key to species.

Diagnostic Features : Body relatively slender, trunk slightly tapering toward head. Snout long, broad, and bell-shaped, preoral snout about 9 to 10% of total length; gill slits small, much less than eye length; gill septa somewhat incised, without pleats or projecting medial lobes; eyes moderately large in adults, between 3 to 4% of total length; nostrils fairly broad, their width about 1.3 in internarial space; incurrent and excurrent apertures moderately large and oval, anterior nasal flaps elongated and triangular; mouth fairly short, moderate-sized and broadly arched, with dental bands hardly expanded and with lower ones falling slightly behind uppers; mouth and labial furrows under eyes; labial folds not enlarged, with lowers diagonal to body axis; mouth and teeth enlarged in males. Interdorsal space about two times greater than first dorsal base, about 2/3 of preorbital snout; first dorsal fin about half the size of second, base of first about 3/5 of that of second; origin of first dorsal somewhat behind pelvic insertions; second dorsal insertion well in front of anal insertion; pectoral fins fairly large, anterior margins about 11 to 14% of total length; inner margins long, nearly the length of pectoral bases; interspace between pectoral and pelvic bases short, somewhat less than preorbital length and about 7 to 9% of total length in adults; pelvic fins fairly high and broadly rounded; anal fin long, fairly high, and angular, between 2.5 and 3 times as long as high, its base about equal to, or slightly greater than prebranchial space and 18 to 22% of total length in adults; caudal fin fairly broad, with a slightly developed, poorly differentiated crest of enlarged denticles on dorsal margin. Lateral trunk denticles with crowns very small, flat and close-set, body surface almost silky-smooth and not with a feltlike or fuzzy texture. Colour dark grey with blackish fin margins. Adults moderately large, 40 to 46 cm.

Geographical Distribution : Western North Atlantic: Leeward Islands off Antigua and Anguilla.



Habitat and Biology : A little-known deepwater bottom shark found on the insular slopes off the Leeward Islands at depth of 687 to 840 m.

Size : Females adult at 39.5 to 45.5 cm, males adult at 42.8 cm.

Interest to Fisheries : None at present.

Literature : Springer (1979).

Remarks : The writer examined the holotype and other material of this species. The above illustration is based on his drawings of the holotype.

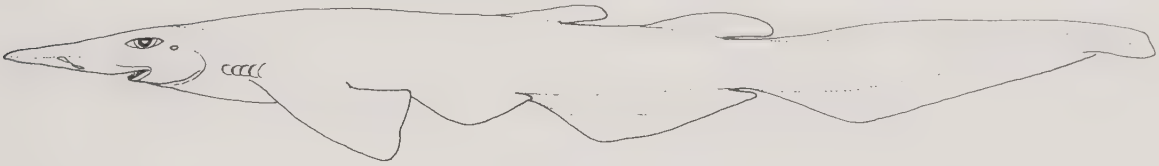
Apristurus herklotsi (Fowler, 1934)

SCYL Aprist 4

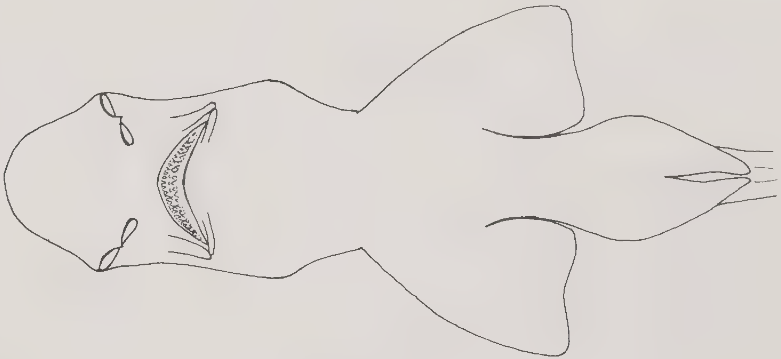
Pentanchus herklotsi Fowler, 1934, Proc.Acad.Nat.Sci.Philad., 85:238, fig. 3. Holotype: U.S. National Museum of Natural History, USNM, 93134, 312 mm total length, immature female. Type Locality: 9°37'N, 121°12.5'E, Cagayan Island, Jolo Sea, The Philippines.

Synonymy : None, but see account of Pentanchus profundicolus.

FAO Names : En - Longfin catshark; Fr - Holbiche à longues nageoires; Sp - Pejegato aletón.



Field Marks : An Apristurus with an unusually short abdomen, long narrow caudal fin without a crest of denticles, a very long low anal fin, and second dorsal fin about half the length of first.



partial ventral view

Diagnostic Features : Body relatively slender, trunk slightly tapering toward head. Snout moderately long, broad, and bell-shaped, preoral snout about 9% of total length; gill slits very small, much less than eye length; gill septa somewhat incised but without pleats or projecting medial lobes; eyes rather small, about 3% of total length; nostrils broad, their width about 1.2 times in internarial space; incurrent and excurrent apertures very narrow and almost slitlike, anterior nasal flap low and angular; mouth fairly short, large, and broadly arched, with dental bands little expanded but with lower ones falling well behind uppers; mouth and labial furrows extending partly in front of eyes; labial folds somewhat enlarged, with lower nearly transverse to body axis. Interdorsal space slightly greater than first dorsal base, about half of preorbital snout; first dorsal fin about a third as large as the second, base of first about half that of second; origin of first dorsal slightly anterior to pelvic insertions; second dorsal insertion well in front of anal insertion; pectoral fins rather large, anterior margins about 14% of total length; inner margins long, nearly the length of pectoral bases; interspace between pectoral and pelvic bases extremely short, about half of preoral snout and about 6% of total length; pelvic fins fairly high and broadly rounded; anal fin very long, fairly high, and rounded-angular, nearly five times as long as high, its base about equal to prebranchial space and 19% of total length; caudal fin rather long and narrow, without a crest of enlarged denticles on dorsal margin. Lateral trunk denticles with crowns flat and close-set, body surface fairly smooth and not with a feltlike or fuzzy texture. Colour brownish without conspicuous markings. Adult size unknown.

Geographical Distribution : Known only from the type locality.

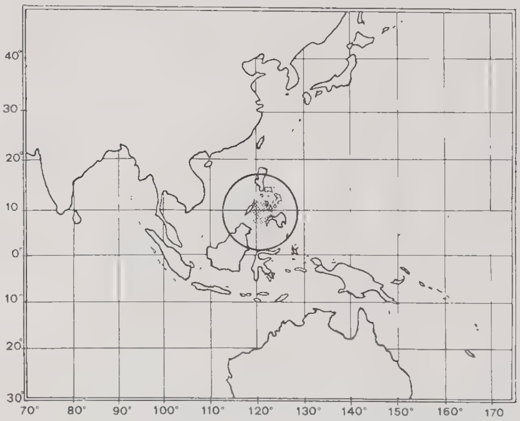
Habitat and Biology : A poorly known deepwater bottom shark, known only from the holotype (Cagayan Island, Jolo Sea, The Philippines).

Size : Maximum 31+cm (immature female holotype).

Interest to Fisheries : None.

Literature : Fowler (1934); Springer (1979).

Remarks : The writer has examined the holotype, a distinctive species closest to the single dorsal-finned Pentanchus profundicolus and possibly identical to it. The above illustration is based on the writer's drawings of the holotype.



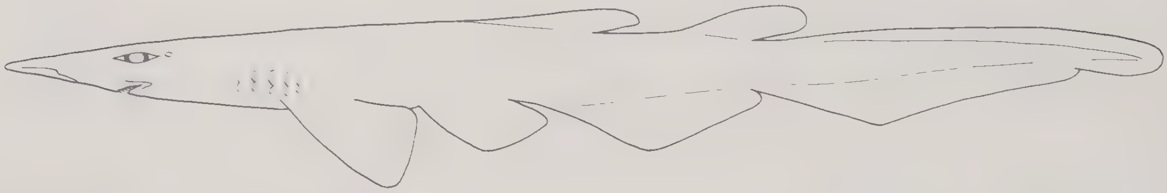
Apristurus indicus (Brauer, 1906)

SCYL Aprist 5

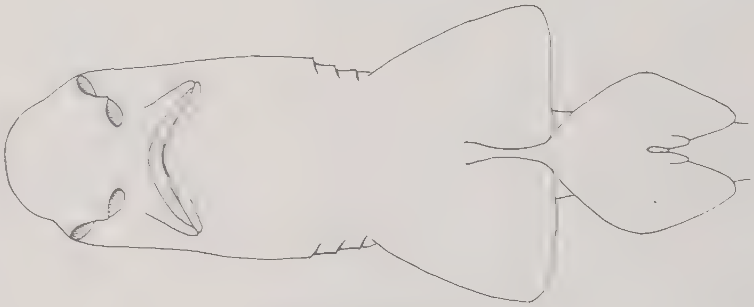
Scylliorhinus indicus Brauer, 1906, Deutsch.Tiefs.Exped.Valdivia, Tiefs.Fisch., 15:8, pl. 14, fig. 1. Lectotype: Zoolgisches Museum an der Humboldt-Universität zu Berlin, ZMB 22424, 336 mm female, designated by Springer (1979:19). Type Locality: 02°59'N, 47°06'E, off coast of Somalia, Indian Ocean.

Synonymy : None.

FAO Names : En - Smallbelly catshark; Fr - Holbiche artouca; Sp - Pejegato Índico.



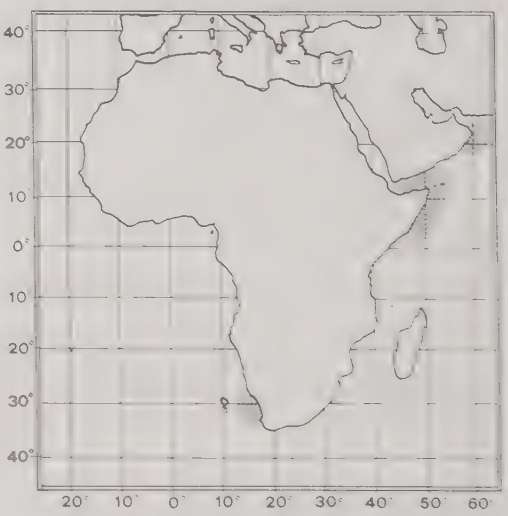
Field Marks : An Apristurus with first dorsal base expanded anteriorly as a long low ridge, and without a caudal crest.



partial ventral view

Diagnostic Features : Body relatively slender, trunk slightly tapering toward head. Snout rather long, very broad, and bell-shaped, preoral snout about 9 to 10% of total length; gill slits moderately small, about 1/2 to 2/3 of eye length; gill septa not incised, with or without short, projecting medial lobes; eyes small, between 2 and 3% of total length; nostrils large, their width about equal to internarial space; incurrent and excurrent apertures fairly large and oval, anterior nasal flaps expanded and angular; mouth short, large, and very broadly arched, with dental bands hardly expanded and with lower ones falling just behind uppers; mouth and labial furrows extending below eyes; labial folds not enlarged, with lowers diagonal to body axis. Interdorsal space about 2/3 of first dorsal base and preorbital snout; first dorsal fin about two-thirds of area of second, but first dorsal base elongated anteriorly as a low ridge and nearly twice the length of second dorsal base; origin of first dorsal extending slightly anterior to pelvic midbases; second dorsal insertion slightly in front of anal insertion; pectoral fins rather large, anterior margins about 13% of total length; inner margins long, nearly the length of pectoral bases; interspace between pectoral and pelvic bases very short, about 2/3 of preorbital snout and about 7% of total length; pelvic fins very high and broadly rounded; anal fin very long, high, and angular, nearly 4 times as long as high, its base about equal to prebranchial space and 16 to 20% of total length; caudal fin very long and narrow, without a crest of enlarged denticles on dorsal margin. Lateral trunk denticles with crowns close-set and fairly flat, body surface smooth and not with a feltlike or fuzzy texture. Colour brownish or blackish. Adults size unknown.

Geographical Distribution : Western Indian Ocean: Somalia, Gulf of Aden, Oman; possibly also eastern South Atlantic off Namibia and South Africa.



Habitat and Biology : A little-known deepwater bottom catshark, from the East African continental slopes at 1289 to 1840 m depth.

Size : Maximum 34+ cm (immatures).

Interest to Fisheries : None.

Literature : Springer (1979).

Remarks : Characters of the diagnosis above are taken in part from a specimen of this species examined by the writer in the British Museum (Natural History), BMNH 1939.5.24.6, 22.7 cm immature female, Gulf of Aden at 1061 to 1080 m depth, as well as from Springer (1979).

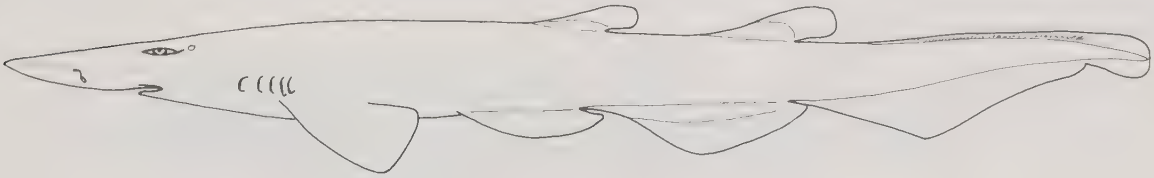
Apristurus _investigatoris_ (Misra, 1962)

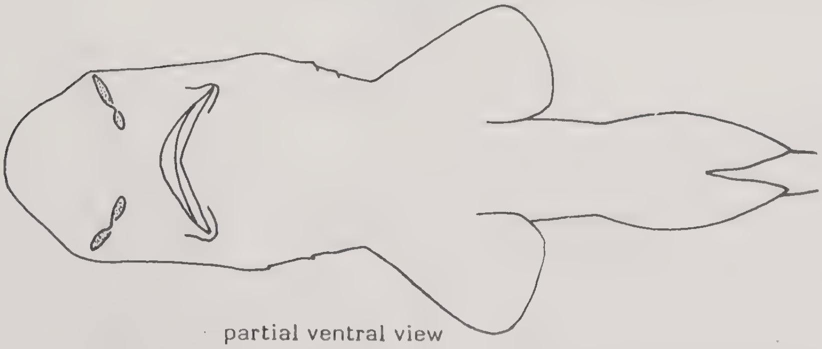
SCYL Aprist 6

Pentanchus (_Parapristurus_) _investigatoris_ Misra, 1962, _Proc.All-India Congr.Zool._, 1(2);636, pl. 1. Holotype: Zoological Survey of India, ZSI-F 1, 627/2, 242 mm female. Type Locality: 11°46'N, 93°10'E, Andaman Sea.

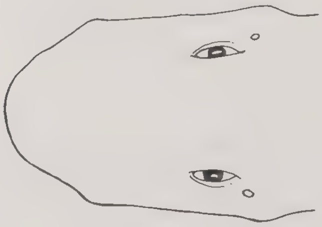
Synonymy : None.

FAO Names : En - Broadnose catshark; Fr - Holbiche platnez; Sp - Pejegato ñato.





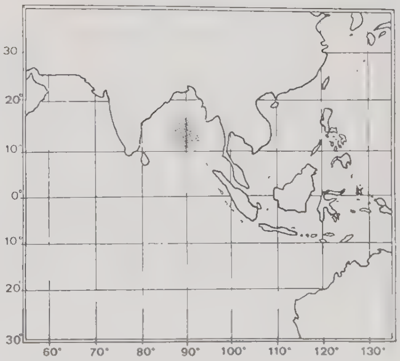
partial ventral view



dorsal view of head

Field Marks : An _Apristurus_ with the first dorsal base elongated anteriorly as a low ridge, and a moderately well-developed caudal crest of denticles.

Diagnostic Features : Body relatively slender, trunk slightly tapering toward head. Snout long, broad, and bell-shaped, preoral snout about 11% of total length; gill slits small, about half of eye length; gill septa incised, without pleats or projecting medial lobes; eyes small, about 2.5% of total length; nostrils very broad, their width about equal to internarial space; incurrent apertures of nostrils fairly narrow and almost slitlike, anterior nasal flaps very low and rounded; mouth short, moderately large, and very broadly arched, with dental bands hardly expanded and with lower ones falling well behind uppers; mouth and labial furrows extending slightly in front of eyes; labial folds not enlarged, with lowers diagonal to body axis. Interdorsal space equal to or slightly less than first dorsal base, about 3/4 of preorbital snout; first dorsal fin about 3/4 as large as second, but first dorsal base with an anterior ridgelike elongation and about 1.5 times the length of second dorsal base; origin of first expanded anteriorly to over first fourth of pelvic bases; second dorsal insertion slightly in front of anal insertion; pectoral fins moderately large, about 13% of total length; inner margins long, nearly the length of pectoral bases; interspace between pectoral and pelvic bases short, about 2/3 of preorbital length and about 7% of total length; pelvic fins fairly low and broadly rounded; anal fin long, rather high, and rounded-angular, almost 4 times as long as high, its base almost equal to prebranchial space and 17% of total length; caudal fin rather broad, with a well-developed crest of enlarged denticles on dorsal margin. Lateral trunk denticles with crowns close-set and somewhat elevated, giving body a rough surface. Colour medium brown. Adult size unknown.



Geographical Distribution : Known only from the type locality (holotype only), in the Andaman Sea.

Habitat and Biology : A deepwater bottom shark, from the eastern Indian ocean continental slope at 1040 m depth.

Size : Maximum 26+cm (presumably immature at this size).

Interest to Fisheries : None at present.

Literature : Misra (1962); Springer (1979).

Remarks : Diagnostic characters and the above illustration are from the holotype, examined by the writer in Calcutta in 1982. The species is very much like _A. indicus_ in its general shape and long first dorsal base, but differs from a similar-sized specimen of that species in having smaller pectoral fins, narrower nostrils, much lower pelvic fins, a much shorter, broader caudal fin, possibly a slightly longer abdomen, and apparently a well-developed supracaudal crest.

Apristurus japonicus Nakaya, 1975

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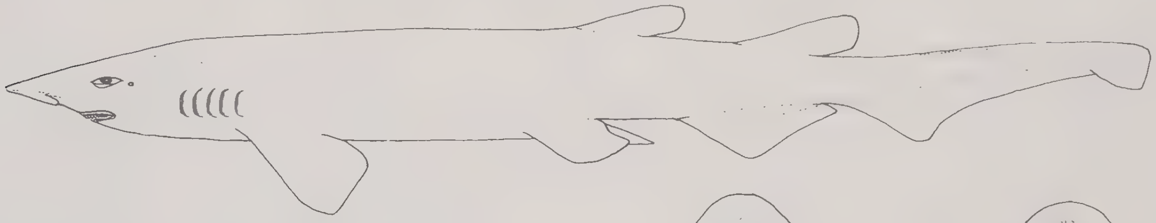
Apristurus japonicus Nakaya, 1975, *Mem.Fac.Fish.Hokkaido Univ.*, 23(1):24, figs 10-11. Holotype: Hokkaido University Laboratory of Marine Zoology, HUMZ 40082, 697 mm adult male. Type Locality: Cape Daito, Chiba Prefecture, Honshu, Japan, western Pacific.

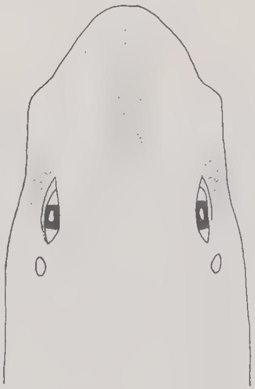
Synonymy : None

FAO Names : En - Japanese catshark; Fr - Holbiche japonnaise; Sp - Pejegato japonés.

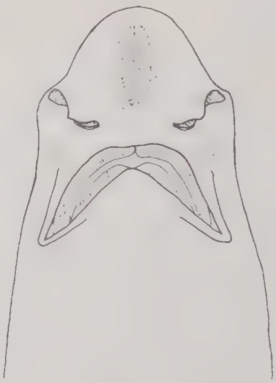


Field Marks : An *Apristurus* with an extremely long abdomen and short snout.

Diagnostic Features : Body relatively slender, trunk slightly tapering toward head. Snout moderately long, broad, and bell-shaped, preoral snout about 7 to 8% of total length; gill slits moderately large, somewhat longer than eye length; gill septa not incised or pleated, with or without short projecting medial lobes; eyes rather small in adults, about 2.4 to 3% of total length; nostrils fairly broad, their width about 1.4 times in internarial space; incurrent and excurrent apertures narrow and oval, anterior nasal flaps broadly triangular; mouth long, large, and broadly arched, with dental bands prominently expanded and with lower ones falling well behind uppers; mouth and labial furrows extending well in front of eyes; labial folds not greatly enlarged, with lowers diagonal to body axis; teeth not greatly enlarged in males, but with slenderer cusps. Interdorsal space slightly less than 1.5 times first dorsal base, subequal to preorbital snout; first dorsal fin about two-thirds as large as second, bases about equally long; origin of first dorsal over last half of pelvic bases; second dorsal insertion in front of anal insertion; pectoral fins moderate-sized, anterior margins about 11 to 14% of total length; inner margins long, nearly the length of pectoral bases; interspace between pectoral and pelvic bases long, almost equal to prepectoral length and about 16% of total length in adults; pelvic fins high and broadly rounded; anal fin moderately long, high and rounded, between 2.5 and 3 times as long as high, its base somewhat greater than prespiracular space and 13 to 15% of total length in adults. Lateral trunk denticles of body with crowns wide-spaced, fairly flat. Colour blackish-brown. Adults large, 63 to 71 cm.

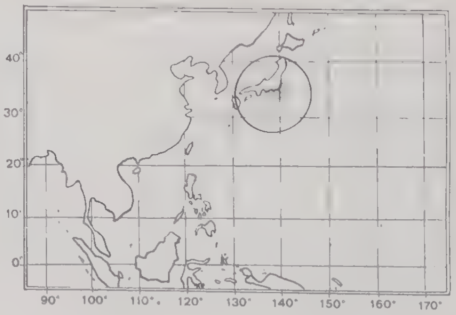


dorsal view of head



underside of head

Geographical Distribution : Known only from off Chiba Prefecture, Honshu, Japan.



Habitat and Biology : An abundant deepwater bottom shark off Chiba Prefecture, but biology little-known. Oviparous.

Size : Adult females reach at least 63 cm, adult males 65 to 71 cm.

Interest to Fisheries : Commonly taken by trawl off the type locality, and possibly utilized for oil, human consumption and fish-meal or fish cakes locally.

Literature : Nakaya (1975); Springer (1979).

Remarks : Data from Nakaya (1975); this species was not examined by the writer.

Apristurus kampae Taylor, 1972

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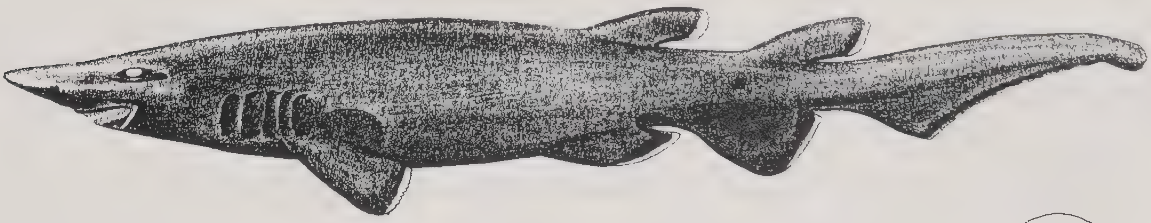
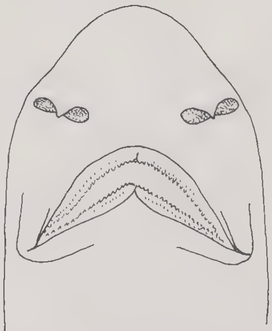
Apristurus kampae Taylor, 1972, Copeia, 1972(1):71, figs 1, 3A, 4-5. Holotype: Scripps Institution of Oceanography, SIO 70-278, 335 mm immature female. Type Locality: 27°22.4' to 27° 10.1'N, 111°10.1' to 111°29.6'W, central Gulf of California, Mexico in 1830 to 1888 m depth.

Synonymy : None.

FAO Names : En - Longnose catshark; Fr - Holbiche tapir; Sp - Pejegato trompudo.



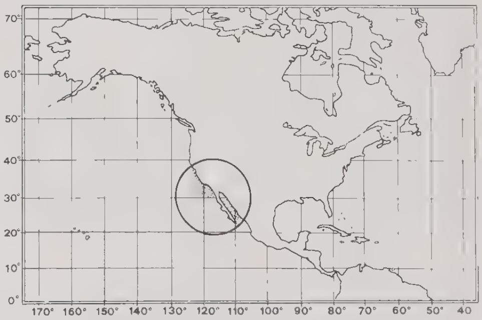


underside of head

Field Marks : An Apristurus with a broad internarial space, very large gill slits, a very high rounded anal fin, and conspicuous white margins on the fins.

Diagnostic Features : Body moderately slender to rather stout, trunk strongly tapering toward head. Snout moderately long, broad, and bell-shaped, preoral snout about 8% of total length; gill slits very large, somewhat greater than eye length; gill septa without projecting medial lobes; eyes rather small in adults, about 3% of total length; nostrils narrow, their width about 1.5 to 1.8 times in internarial space; incurrent and excurrent apertures enlarged and oval, anterior nasal flaps elongated and triangular; mouth long, large, and broadly arched, with dental bands prominently expanded and with lower ones falling well behind uppers; mouth and labial furrows extending well in front of eyes; labial folds somewhat enlarged, with lower nearly transverse to body axis; mouth and teeth enlarged in males. Interdorsal space equal to, or slightly greater than first dorsal base, slightly less than preorbital snout. First dorsal fin about as large as second, bases about equally long; origin of first dorsal slightly anterior to pelvic midbases; second dorsal insertion behind anal insertion; pectoral fins rather small, anterior margins about 10 to 12% of total length; inner margins long, nearly length of pectoral bases; interspace between pectoral and pelvic bases moderately long, slightly less than prebranchial length and about 16% of total length in adults; pelvic fins high and broadly rounded; anal fin short, high, and rounded, slightly more than twice as long as high, its base about equal to prespiracular space and 12% of total length in adults; caudal fin rather broad, without a crest of enlarged denticles on dorsal margin. Lateral trunk denticles of body with crowns fairly flat and close-set, surface fairly smooth and not with a feltlike or fuzzy texture. Colour blackish, with conspicuous white posterior margins on precaudal fins. Adults moderately large, adult female 52 cm.

Geographical Distribution : Eastern North Pacific: Central and southern California, USA and Gulf of California, Mexico.



Habitat and Biology : A little-known deepwater bottom shark of the eastern Pacific upper continental slope down to 1888 m depth. Oviparous, with a single egg laid per oviduct.

Size : Adult females to at least 52 cm.

Interest to Fisheries : None. Incidentally taken in deep trawls and sablefish traps off California.

Literature : Taylor (1972); Springer (1979).

Remarks : Taylor (1972) recorded a second specimen of this species from the Galapagos Islands, but this appears to be another species of uncertain identity (Springer, 1979). The writer has examined adult specimens of a catshark from the Galapagos and Peru that may be an undescribed species if it is not the adult of A. stenseni; I have not examined Taylor's Galapagos specimen, but from its account and illustration in Taylor (1972) this juvenile shark (SIO 70 to 299, 201 mm immature male) may very likely be conspecific with the aforementioned adults. It has narrow nostrils and a broad internarial space as in A. kampae and several other related species.

Recently, several specimens of true A. kampae have been collected in deepwater trawl hauls and sablefish traps off central and southern California. In addition to these, there may be a related undescribed species rather like the distinctive, heavy-bodied, big-finned kampae, with smaller gill openings and other distinguishing features.

Springer (1979) distinguished this species from other Apristurus by its short anal fin (approached by several species, especially A. spongiceps), with "...its rear tip separated from origin of lower caudal lobe by a distance greater than half the length of the eye opening." Examination of California specimens of kampae indicates that the ventral caudal origin is just behind the anal base insertion in this species as in other members of the genus, but that the preventral margin of the caudal fin is indented just behind its origin (also found to a greater or lesser extent in several other species of Apristurus). However, this species is readily distinguished from all other Apristurus by the character combination given above. It resembles A. riveri in its very wide gill slits, but differs from that species in numerous features.

Apristurus laurussoni (Saemundsson, 1922)

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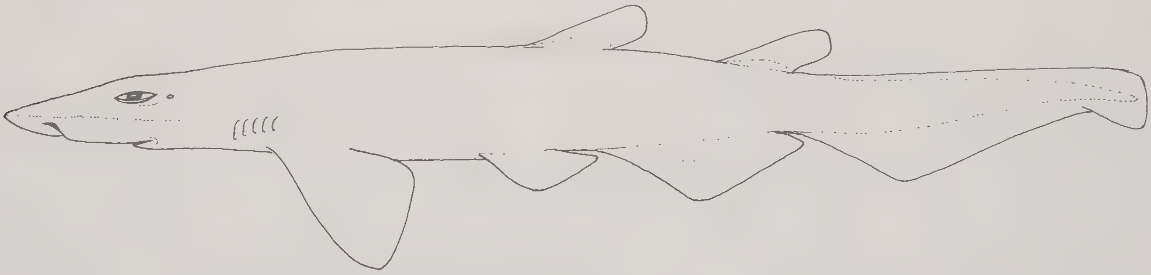
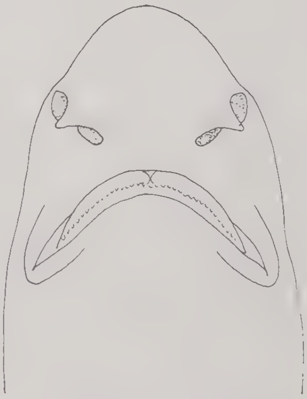
Scyllium laurussoni Saemundsson, 1922, Vidensk.Medd.Dan.Naturhist.Foren.Kbh., 74:73, pl. 4, fig. 2, pl. 5, fig. 4. Holotype: Natural History Museum, Reykjavik, Iceland, NHMR, 673 mm female. Type Locality: Near Vestmannaeyjar Island, southern Iceland, 560 m.

Synonymy : None.

FAO Names : En - Iceland catshark; Fr - Roussette d'Islande; Sp - Pejegato islándico.



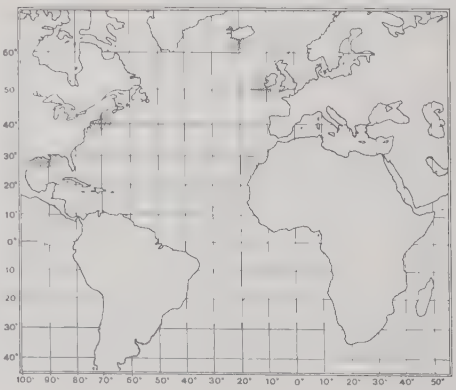
Field Marks : See diagnostic features and key to species.



underside of head

Diagnostic Features : Body relatively slender, trunk slightly tapering toward head. Snout moderately long, broad, and bell-shaped, preoral snout about 7 to 8% of total length; gill slits short, less than eye length; gill septa without projecting medial lobes or pleats, somewhat incised; eyes rather small in adults, about 3% of total length. Nostrils fairly broad, their width about 1.4 times in internarial space; incurrent and excurrent apertures large and oval, anterior nasal flaps long and angular; mouth long, moderately large, and broadly arched, with dental bands somewhat expanded and with lower ones falling well behind uppers; mouth and labial furrows about opposite eyes; labial folds somewhat enlarged, with lower diagonal to body axis; mouth and teeth not greatly enlarged in males. Interdorsal space somewhat greater than first dorsal base, slightly less than preorbital snout; first dorsal fin about as large as second, bases about equally long; origin of first dorsal slightly anterior to pelvic midbases; second dorsal insertion about opposite anal insertion; anal fin short, fairly high, and angular, slightly more than three times as long as high, its base somewhat greater than prespiracular space and 14 to 17% of total length in adults; pectoral fins small, anterior margins about 12 to 13% of total length; inner margins long, about length of pectoral bases; interspace between pectoral and pelvic bases short, slightly less than prebranchial length and about 11% of total length in adults; pelvic fins high and broadly rounded; caudal fin fairly broad, without a dorsal crest of enlarged denticles. Lateral trunk denticles of body with crowns fairly flat and closely imbricated, surface fairly smooth and without a feltlike or fuzzy texture. Colour dark brown, without light-margined dorsal fins. Adults large, to 68 cm.

Geographical Distribution : Western North Atlantic: Massachusetts, Delaware, northern Gulf of Mexico. Eastern North Atlantic: Iceland, southwestern Ireland, Canary Islands.



Habitat and Biology : A little-known deepwater catshark, apparently fairly common on the upper continental slopes, on or near bottom at 560 to 1462 m depth. Presumably oviparous.

Size : Maximum about 68 cm, adult male 68 cm, adult female 67 cm.

Interest to Fisheries : None at present.

Literature : Springer (1966, 1979).

Apristurus longicephalus Nakaya, 1975

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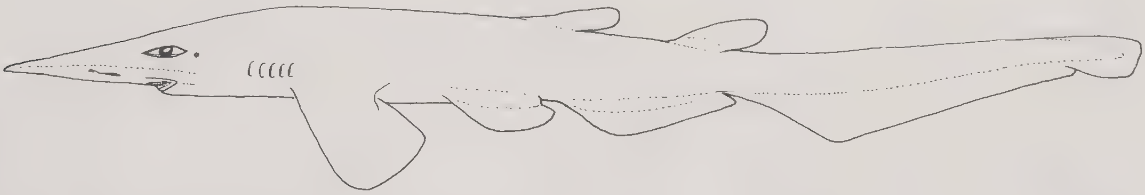
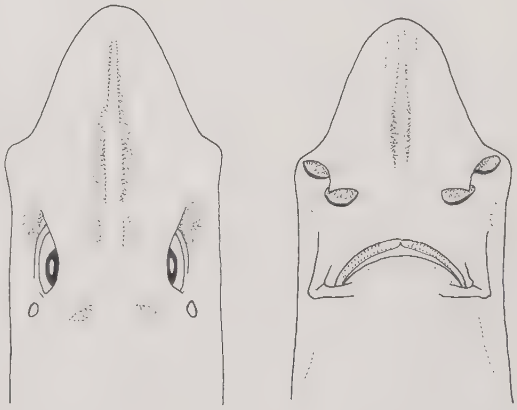
Apristurus longicephalus Nakaya, 1975, *Mem.Fac.Fish.Hokkaido Univ.*, 23(1):32, fig. 15-16. Holotype: Hokkaido University Laboratory of Marine Zoology, HUMZ 42399, 375 mm immature male. Type Locality: 33°13'N, 133°44'E, Tosa Bay, Kochi Prefecture, Honshu, Japan, western Pacific.

Synonymy : None.

FAO Names : En - Longhead catshark; Fr - Holbiche à grande tête; Sp - Pejegato cabezón.





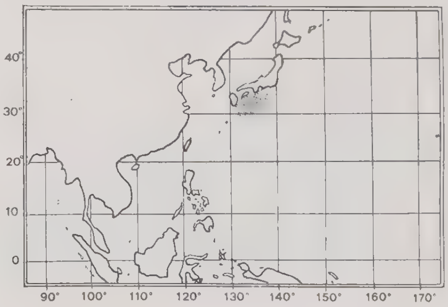
dorsal view of head

underside of head

Field Marks : An *Apristurus* with an unusually long snout, about 12% of total length.

Diagnostic Features : Body relatively slender, trunk slightly tapering toward head. Snout long, basally broad but distally narrowly parabolic and bell-shaped, preoral snout about 12% of total length; gill slits small, less than eye length; gill septa without projecting medial lobes or pleats, hardly incised; eyes rather small in the type, about 3% of total length; nostrils broad, their width about 1.3 times in internarial space; incurrent and excurrent apertures very large and oval, anterior nasal flaps long and angular; mouth fairly short, moderate-sized and broadly arched, with dental bands slightly expanded and with lower ones falling just behind uppers; mouth under eyes and upper labial furrows extending slightly in front of them; labial folds somewhat enlarged, with lower nearly transverse to body axis. Interdorsal space slightly greater than first dorsal base, about half preorbital snout; first dorsal fin smaller than second, its base about 2/3 length of second; origin of first dorsal opposite rear third of pelvic bases; second dorsal insertion opposite to anal insertion; pectoral fins rather small, anterior margins about 12% of total length; inner margins long, nearly length of pectoral bases; interspace between pectoral and pelvic bases very short, slightly less than prenarial length and about 6% of total length in holotype; pelvic fins moderately high and broadly rounded; anal fin very long, low, and angular, about a fifth as high as long, its base almost equal to prespiracular space and 15% of total length; caudal fin long and narrow, without a dorsal crest of enlarged denticles. Lateral trunk denticles of body with crowns fairly flat and well-separated, surface apparently smooth and without a feltlike or fuzzy texture. Colour grey-black, without conspicuous markings. Adult size unknown.

Geographical Distribution : Known only from the type locality (near Misaki, Japan).



Habitat and Biology : Almost totally unknown, inhabits deep water, probably near the bottom.

Size : Maximum over 37.5 cm, but adult size unknown.

Interest to Fisheries : None.

Literature : Nakaya (1975); Springer (1979).

Remarks : Data from Nakaya (1975); this species was not examined by the writer. There are somewhat similar long-nosed *Apristurus* from off Australia and New Zealand, but these among other things differ from this species and all other members of the genus in having much longer, narrower, almost *Mitsukurina*-like snouts. At least one and possibly two new species may be represented.

Apristurus macrorhynchus (Tanaka, 1909)

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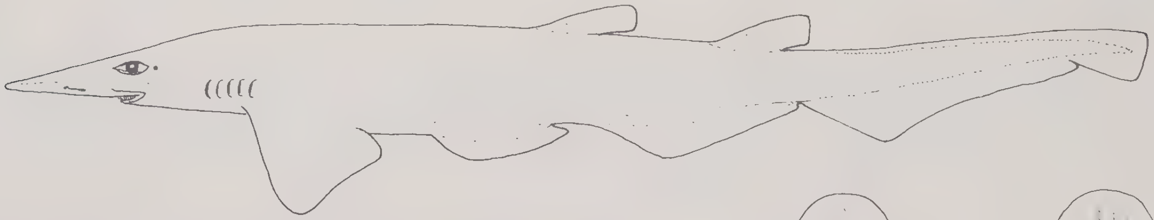
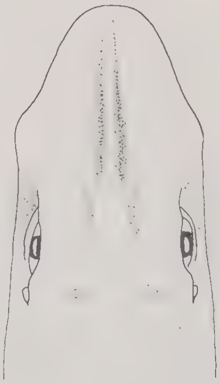
Scyliorhinus macrorhynchus Tanaka, 1909, J.Coll.Sci., Imp.Univ.Tokyo, 23:1. Holotype: Imperial University of Tokyo, no. 2153, 470 mm immature male. Type Locality: Near Misaki, Japan.

Synonymy : None.

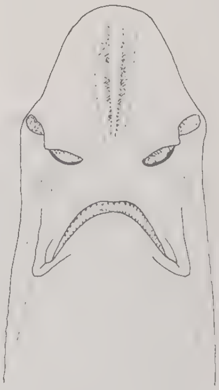
FAO Names : En - Flathead catshark; Fr - Holbiche torazame; Sp - Pejegato chato.



Field Marks : See diagnostic features and key to species.



dorsal view of head



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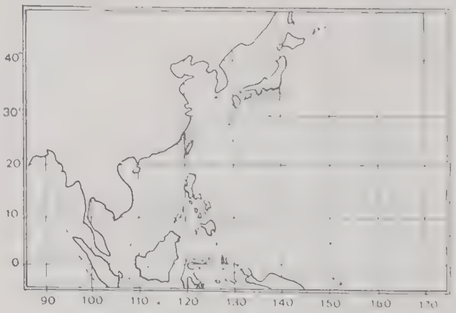
Diagnostic Features : Body relatively slender, trunk slightly tapering toward head. Snout moderately long, broad, and bell-shaped, preoral snout about 10 to 11% of total length; gill slits small, less than eye length; gill septa without projecting medial lobes; eyes rather small in adults, about 3% of total length; nostrils broad, their width 1.1 times the internarial space; incurrent and excurrent apertures moderately large and elongate-oval, anterior nasal flaps low and rounded; mouth long, large, and broadly arched, with dental bands not greatly expanded and with lower ones just behind uppers; mouth and labial furrows below eyes; labial folds not enlarged, with lower diagonal to body axis; mouth and teeth probably not enlarged in males. Interdorsal space almost twice first dorsal base, about equal to preorbital snout; first dorsal fin about two thirds as large as second, second dorsal base about 1.2 times the length of first; origin of first dorsal above posterior half of pelvic bases; second dorsal insertion somewhat in front of anal insertion; pectoral fins rather small, anterior margins about 11 to 13% of total length; inner margins fairly long, nearly length of pectoral bases; interspace between pectoral and pelvic bases short, about equal to preoral snout and about 8% of total length in adults; pelvic fins fairly low and broadly rounded; anal fin long, low, and angular, about four times as long as high, its base about equal to prebranchial space and 18 to 19% of total length in adults; caudal fin fairly long and narrow, without a dorsal crest of enlarged denticles. Lateral trunk denticles of body with crowns fairly flat and close-set, surface smooth and without a feltlike or fuzzy texture. Colour light grey brown above, whitish below and on fins. Adults moderately large, to about 67 cm.

Geographical Distribution : Western North Pacific: Japan (southeastern Honshu), and China (Taiwan Island).



Habitat and Biology : A little-known deepwater bottom shark from the slopes off Japan and Taiwan Island. Oviparous, with one egg per oviduct.

Size : Maximum about 66 cm (adult female).

Interest to Fisheries : None.

Literature : Nakaya (1975); Springer (1979).

Remarks : The account of this species follows Nakaya (1975).

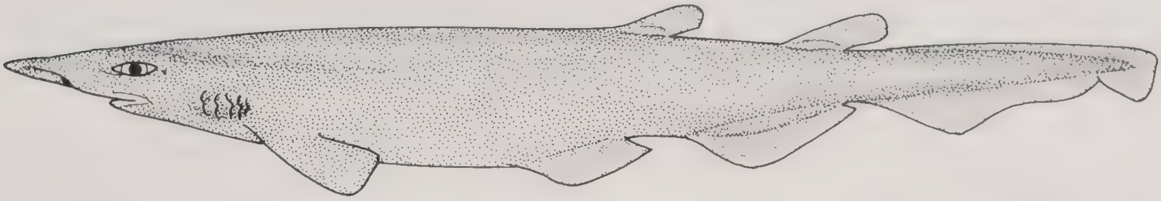
Apristurus maderensis Cadenat & Maul, 1966

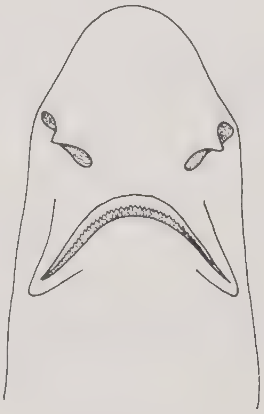
SCYL Aprist 12

Apristurus maderensis Cadenat & Maul, 1966, Bull.Inst.Fondam.Afr.Noire (A Sci.Nat.), 28(2):769, figs 1-4. Holotype: Museau Municipal do Funchal, MMF 18750, 668 mm adult female. Type Locality: Camara de Lobos, Madeira, eastern Atlantic, depth from 600 to 1000 m.

Synonymy : None.

FAO Names : En - Madeira catshark; Fr - Roussette de Madère; Sp - Pejegato de Madera.





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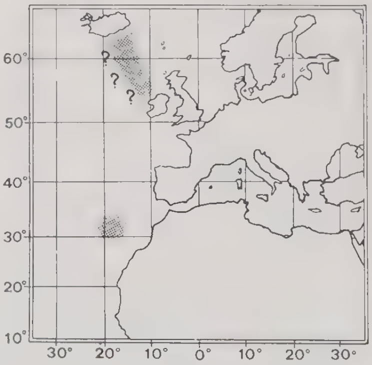
Field Marks : At least in the holotype, greatly elongated medial projections on gill septa, possibly less developed in other specimens.

Diagnostic Features : Body relatively slender, trunk slightly tapering toward head. Snout moderately long, broad, and bell-shaped, preoral snout about 8% of total length; gill slits short, considerably less than eye length; gill septa without pleats but moderately incised and with strongly projecting medial lobes; eyes rather small in adults, about 3% of total length; nostrils broad, their width about 1.1 times the internarial space; incurrent and excurrent apertures very large and oval, anterior nasal flaps long and angular; mouth long, large, and broadly arched, with dental bands slightly expanded and with lower ones falling well behind uppers; mouth and labial furrows extending slightly in front of eyes; labial folds not enlarged, with lower diagonal to body axis. Interdorsal space about twice length of first dorsal base, about equal to preorbital snout; first dorsal fin about half area of second, base of first about 3/4 of second; origin of first dorsal opposite last fourth of pelvic bases; second dorsal insertion slightly in front of anal insertion; pectoral fins rather small, anterior margins about 12% of total length; inner margins long, nearly length of pectoral bases; interspace between pectoral and pelvic bases moderately long, about equal to preorbital length and about 18% of total length in adult holotype; pelvic fins low and angular; anal fin fairly short, high, and angular, slightly more than three times as long as high, its base slightly greater than prespiracular space and 15% of total length in adults; caudal fin fairly short and broad, apparently without a dorsal crest of enlarged denticles. Lateral trunk denticles of body with crowns fairly flat and closely imbricated, surface fairly smooth and without a feltlike or fuzzy texture. Colour blackish, without conspicuous markings. Adults moderately large, adult female 67 cm.

Geographical Distribution : Eastern North Atlantic, Madeira; possibly also from Iceland and Bill Bailey, Lousy and Great Sole Banks, eastern North Atlantic slope.



Habitat and Biology : Continental slopes of eastern North Atlantic on or near bottom at depths from 700 to 1500 m. Oviparous, apparently with a single egg per uterus.

Size : Maximum at least 68.1 cm for adult males and 66.8 cm for adult females.

Interest to Fisheries : None.

Literature : Cadenat & Maul (1966); Nakaya (1975); Springer (1979).

Remarks : The account of this species follows Cadenat & Maul (1966). Seven specimens of an Apristurus in the collections of the Institut für Seefischerei, Hamburg, were examined by the writer in 1979 and found to be very similar to the type of A. maderensis as described by Cadenat & Maul. These specimens (labelled as LJVC "Apristurus F") were collected off Iceland and the Bill Bailey, Lousy and Great Sole Banks and are tentatively placed in A. maderensis.

Apristurus manis (Springer, 1979)

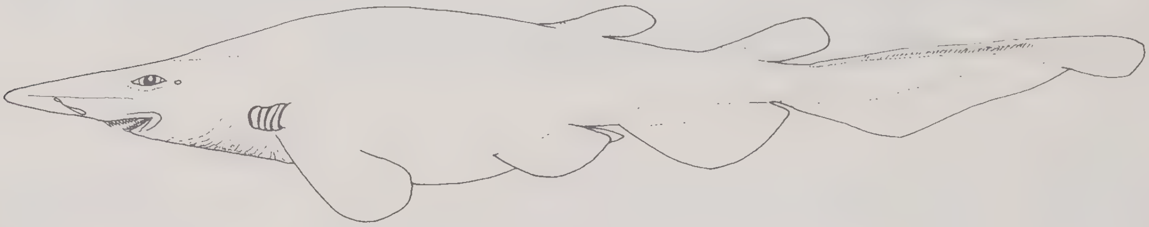
SCYL Aprist 13

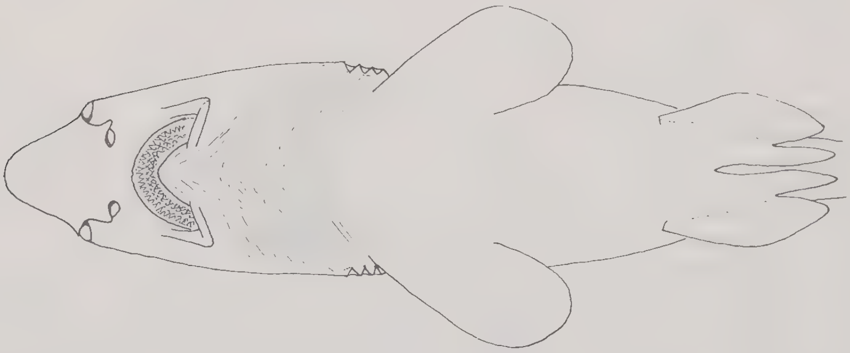
Parmaturus manis Springer, 1979, NOAA Tech.Rep.NMFS Circ., (422):102, figs 60-63. Holotype: Museum of Comparative Zoology, Harvard, MCZ 38299, 328 mm immature female. Type Locality: 39°52'N, 70°50'W, southwest of Nantucket, Massachusetts, USA, in 731 to 841 m depth.

Synonymy : None.

Other Scientific Names Recently in Use : Apristurus profundorum (not Goode & Bean, 1896) of Springer (1966; see also Springer, 1979); Parmaturus manis Springer, 1979.

FAO Names : En - Ghost catshark; Fr - Holbiche fantôme; Sp - Pejegato fantasma.



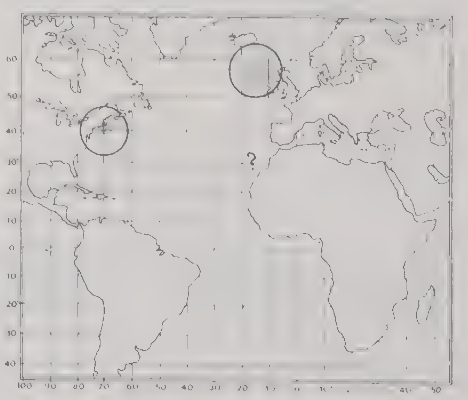


partial ventral view

Field Marks : An Apristurus with a distinctively thick body tapering anteriorly as a wedge to the snout tip, very small eyes, anteriorly expanded mouth, very sparse erect denticles on body, a prominent caudal crest of denticles, and sometimes white fin tips.

Diagnostic Features : Body relatively stout (especially in adults), trunk strongly tapering toward head. Snout long, relatively narrow and bell-shaped, preoral snout about 9 to 11% of total length; gill slits moderately large, but somewhat less than eye length; gill septa without pleats or projecting medial lobes, well incised; eyes rather small and all sizes, between 2 and 3% of total length; nostrils fairly broad, their width about 1.1 times in internarial space; incurrent and excurrent apertures very large and circular, anterior nasal flaps long and angular; mouth long, large, and broadly arched, particularly in adult males, with dental bands prominently expanded and with lower ones falling well behind uppers; mouth and labial furrows extending well in front of eyes; labial folds somewhat enlarged, but with lowers diagonal to body axis; mouth and teeth enlarged in adult males. Interdorsal space slightly greater than first dorsal base, about two-thirds of preorbital snout; first dorsal fin slightly smaller than second, its base of first over 3/4 length of second. Origin of first dorsal over or slightly anterior to pelvic midbases; second dorsal insertion opposite anal insertion; pectoral fins small, anterior margins about 8 to 13% of total length; inner margins long, nearly length of pectoral bases; interspace between pectoral and pelvic bases short, equal or less than preorbital length and about 9 to 12% of total length in young and adults; pelvic fins high and broadly rounded; anal fin rather short, high, and rounded, about three times as long as high, its base about equal to prespiracular space and 13 to 16% of total length in young and adults; caudal fin long and narrow, with a conspicuous crest of enlarged denticles on its dorsal margin. Lateral trunk denticles of body with crowns erect, unusually far from one another and not imbricate, and with a prickly but not feltlike texture. Colour grey or blackish, with light tips on pectorals and dorsals of young at least. Adults large, adult male 85 cm.

Geographical Distribution : Western North Atlantic off Massachusetts; eastern North Atlantic from Porcupine Bank west of Ireland; nominal "Apristurus profundorum" from off Mauritania (Golovan, 1976) possibly are this species also.



Habitat and Biology : A little known but singular bottom-dwelling catshark of the Atlantic continental slopes at depths from 658 to 1740 m.

Size : Females to at least 75.8 cm, adult males to 85.2 cm.

Interest to Fisheries : None.

Literature : Springer (1966, 1979).

Remarks : Springer (1966) confused small western North Atlantic examples of this species with A. profundorum, which also has a caudal crest of denticles. Later Springer (1979) named a new species for it, manis, and placed it in Parmaturus along with his new stenseni in a new subgenus Compagnoia. In 1979 the writer examined two large eastern Atlantic scyliorhinids in the Institut für Seefischerei, Hamburg, that are apparently conspecific with manis, and the largest of which (an 852 mm adult male), is illustrated above. The rationalle for placing this species and stenseni in Apristurus rather than Parmaturus is discussed in the remarks for this genus.

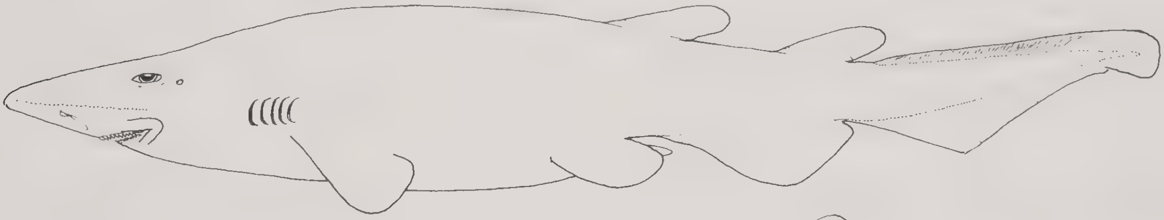
Apristurus microps (Gilchrist, 1922)

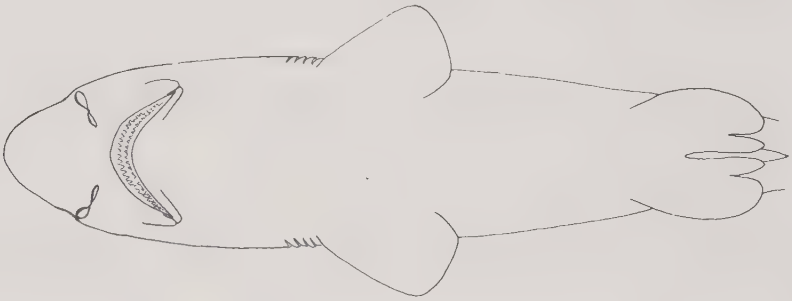
SCYL Aprist 14

Scylliorhinus microps Gilchrist, 1922, Rep.Fish.Mar.Biol.Surv.Union of South Africa, 2(Spec.rept. 3):46, pl. 7, fig. 1. Holotype: A specimen of unknown size (but probably small and below 300 mm judging from its proportions), now lost. Type Locality: Eastern South Atlantic west of Cape Town, South Africa, 33°45.8'S, 17°17.1'E, 1445 m depth.

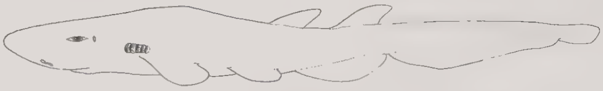
Synonymy : None.

FAO Names : En - Smalleye catshark; Fr - Holbiche porc; Sp - Pejegato puerco.





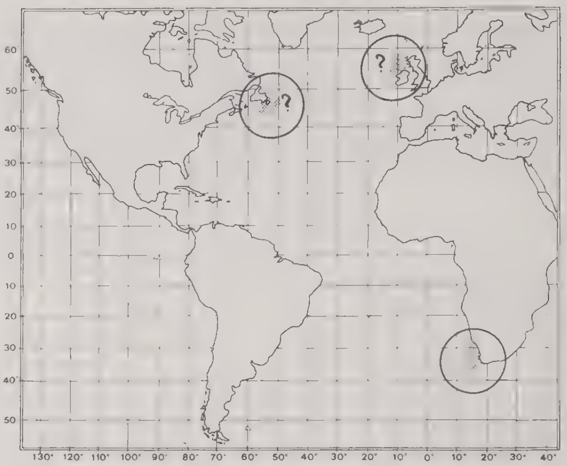
partial ventral view



holotype, after Gilchrist

Field Marks : An Apristurus with an unusually small eye, thick snout, very short interdorsal space, anteriorly projecting mouth, very short pectoral inner margins, and a supracaudal crest of denticles.

Diagnostic Features : Body relatively stout, especially in subadults, trunk slightly tapering toward head. Snout moderately long, broad, and bell-shaped, preoral snout about 9 to 10% of total length; gill slits moderately large, somewhat less than or equal to eye length; gill septa without projecting medial lobes or pleats, well-incised; eyes very small, especially in subadults, less than 3% of total length; nostrils broad, width about 1.2 times in internarial space; incurrent and excurrent apertures very narrow and slitlike, anterior nasal flaps very low; mouth long, large, and broadly arched, with dental bands prominently expanded and with lower ones falling just behind uppers; mouth and labial furrows extending well in front of eyes; labial folds enlarged, but with lower diagonal to body axis. Interdorsal space equal to or slightly less than first dorsal base, one-third to two-fifths of preorbital snout; first dorsal fin about as large or slightly smaller than second, bases about equally long or first slightly shorter than second; origin of first dorsal about opposite last third of pelvic bases; second dorsal insertion behind anal insertion; pectoral fins rather small, anterior margins about 9 to 11% of total length; inner margins extremely short, about a third of pectoral bases; interspace between pectoral and pelvic bases short to moderately long, two-fifths to subequal to prespiracular length and about 6 to 14% of total length; pelvic fins high and broadly rounded; anal fin short, fairly high, and rounded, between three and four times as long as high, its base about equal to prespiracular space and 14 to 16% of total length; caudal fin slender to moderately broad, with a loose crest of enlarged denticles on dorsal caudal margin. Lateral trunk denticles of body with crowns erect and not closely imbricate, skin surface with a feltlike or fuzzy texture. Colour dusky brown or grey-brown to purplish-black, without conspicuous markings on fins. Adults probably large, adolescents to 54 cm.



Geographical Distribution : Eastern South Atlantic: Southwestern Cape Province, South Africa. ? Eastern North Atlantic: between Scotland and Iceland. ? Western North Atlantic: Off Newfoundland.

Habitat and Biology : A poorly known bottom-dwelling shark of the eastern and western Atlantic continental slopes, on or near the bottom, at depths of 1000 to 2000 m.

Size : Maximum over 54 cm (adolescent male tentatively referred to this species).

Interest to Fisheries : None.

Literature : Gilchrist (1922); Springer (1979).

Remarks : The holotype, of unknown size, was apparently discarded (P.C. Heemstra, pers.comm.). Ten specimens in the Institut für Seefischerei, Hamburg, examined by the writer in 1979 (and labelled as LJVC "Apristurus B") fit this species well in most details, but disagree with Gilchrist's (1922) and Springer's (1979) characterizations in a few particulars, especially in having somewhat longer abdomen and shorter caudal fin, that may be size-related (assuming that the holotype was small). However, they agree with microps in having exceptionally short pectoral inner margins, thick snouts, thick bodies, broadly rounded fins, equal-sized dorsals with the origin of the first over the pelvic bases, unusually short interdorsal spaces, and very small eyes. These specimens are tentatively identified as Apristurus microps here, and were taken off the Cape region of South Africa (2 specimens), the eastern North Atlantic between Iceland and Scotland (4), and on the Newfoundland Bank (4) in the western Atlantic. The largest specimen, a 54 cm adolescent male from the eastern North Atlantic, is illustrated above.

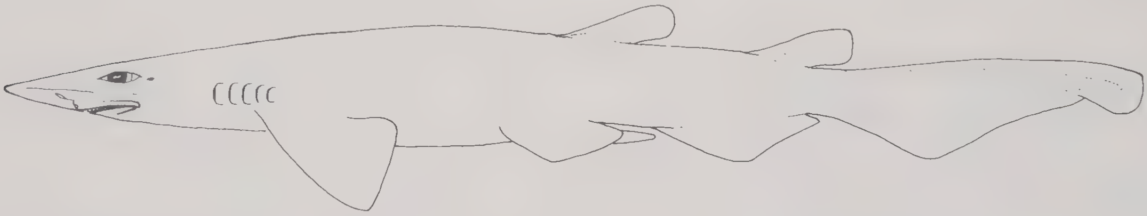
Apristurus nasutus de Buen, 1959

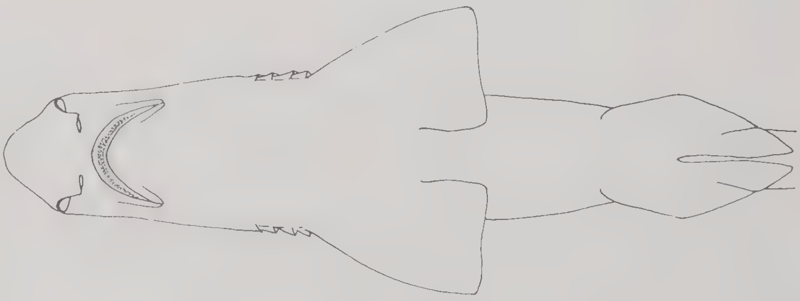
SCYL Aprist 15

Apristurus nasutus de Buen, 1959a, Bol.Mus.Nac.Hist.Nat., Chile, 27(3):176. Holotype: Estación de Biología Marina, Universidad de Chile, EBMCh. 10.184, 594 mm adult male, apparently lost? Type Locality: Near Valparaiso, Chile, eastern South Pacific, 400 m depth.

Synonymy : None.

FAO Names : En - Largenose catshark; Fr - Holbiche cyrano; Sp - Pejegato hocicón.




partial ventral view

Field Marks : See diagnostic features and key to species.

Diagnostic Features : Body moderately slender, trunk slightly tapering toward head. Snout moderately long, broad, and bell-shaped, preoral snout about 7 to 8% of total length; gill slits of moderate size, much less than eye length; gill septa without projecting medial lobes or pleats but with incised margins; eyes small in adults, between 3 and 4% of total length; nostrils narrow, their width about equal to internarial space; incurrent and excurrent apertures moderately large and oval, anterior nasal flaps long and angular; mouth long, moderately large, and broadly arched, with dental bands not expanded and with lower ones falling just behind uppers; mouth and labial furrows extending slightly in front of eyes; labial folds not enlarged, with lowers diagonal to body axis; mouth and teeth not enlarged in males. Interdorsal space about 1.5 times first dorsal base, slightly greater than preorbital snout and considerably greater than preoral snout; first dorsal fin about as large as second, bases about equally long; origin of first dorsal about opposite pelvic midbases; second dorsal insertion about opposite anal insertion; pectoral fins moderately large, anterior margins about 12 to 14% of total length; inner margins long, about 3/5 of pectoral bases; interspace between pectoral and pelvic bases fairly short, about 2/3 of prebranchial length and about 14% of total length in adults; pelvic fins low and angular; anal fin moderately long, high, and angular, slightly more or less than three times as long as high, its base slightly greater than prespiracular space and 12 to 15% of total length in adults. No dorsal crest of enlarged caudal denticles. Lateral trunk denticles of body with crowns fairly flat, skin surface smooth and without feltlike or fuzzy texture. Colour medium brown, grey or grey-blackish, without conspicuous markings on fins. Adults moderately large, to 56 cm.

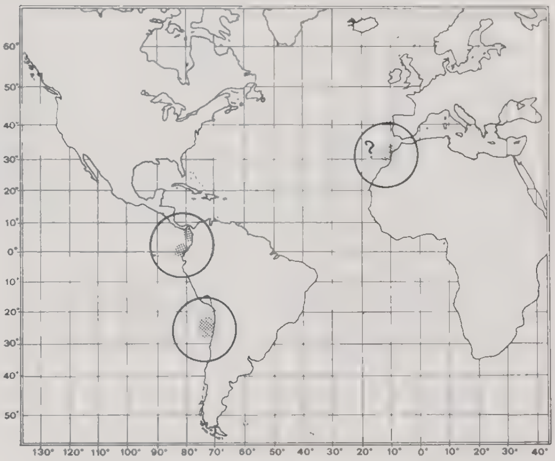
Geographical Distribution : Eastern Pacific: Gulf of Panama, Ecuador and central Chile. Also nominally recorded from the eastern North Atlantic off Morocco, but identification uncertain.

Habitat and Biology : A little-known bottom-dwelling shark of the upper continental slopes on or near the bottom at 400 to 925 m depth in the eastern Pacific. Nominal records off Morocco have this species at 500 to 1000 m depth, but this is uncertain.

Size : Maximum total length 59 cm, adults males from 51 to 59 cm, females not reported.

Interest to Fisheries : None.

Literature : Golovan (1978); Springer (1979).



Remarks : It is uncertain at present if this species occurs in the eastern North Pacific or not, where it may have been confused with A. brunneus. Eastern Atlantic records by Golovan (1978) may be based on some other species. The illustration is based on drawings by the writer of an adult male from Valparaiso, Chile.

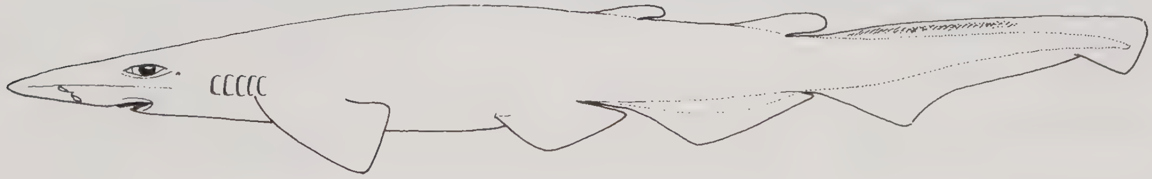
Apristurus parvipinnis Springer & Heemstra, 1979

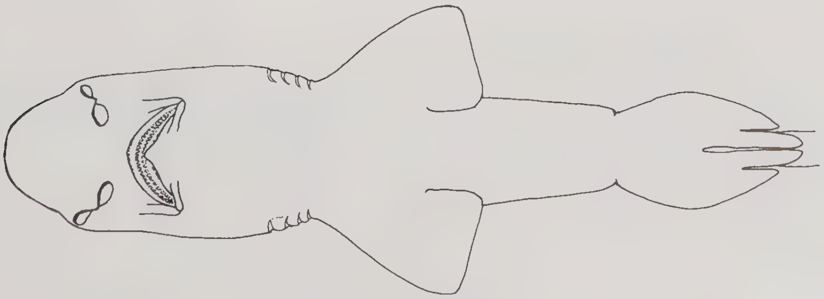
SCYL Aprist 16

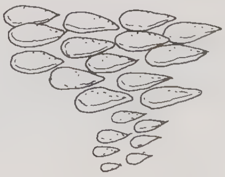
Apristurus parvipinnis Springer & Heemstra, in Springer, 1979, NOAA Tech.Rep.NMFS Circ., (422):25, fig. 15. Holotype: U.S. National Museum of Natural History, USNM 206178, 476 mm male. Type Locality: Gulf of Mexico off Pensacola, Florida, USA, in 1115 m depth.

Synonymy : None.

FAO Names : En - Smallfin catshark; Fr - Holbiche petites ailes; Sp - mocho.

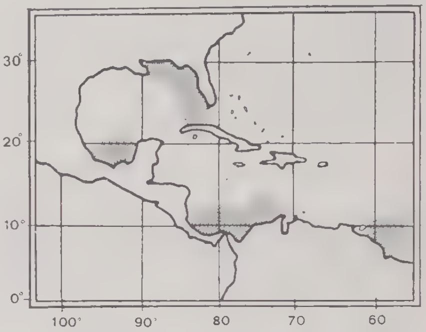



partial ventral view


dermal denticles

Field Marks: One of several species of Apristurus with the first dorsal fin about half the area of the second. See diagnostic features and key to species for other characters.

Diagnostic Features: Body relatively slender, trunk slightly tapering toward head. Snout moderately long, broad, and bell-shaped, preoral snout about 9 to 10% of total length; gill slits small, considerably less than eye length; gill septa without projecting medial lobes or pleats but more or less incised; eyes rather small in adults, about 3% of total length; nostrils broad, their width about 1.2 times in internarial space; incurrent and excurrent apertures fairly broad and oval, anterior nasal flaps high and angular; mouth short, relatively small and broadly arched, with dental bands moderately expanded and with lower ones falling slightly behind uppers; mouth and labial furrows hardly extending in front of eyes; labial folds not enlarged, with lowers diagonal to body axis; mouth and teeth not enlarged in males. Interdorsal space about twice the first dorsal base, slightly less than preorbital snout; first dorsal fin half to one fourth the area of second, base of first about two-thirds of second; origin of first dorsal behind pelvic insertions, between them and anal origin; second dorsal insertion well in front of anal insertion; pectoral fins small to moderately large, anterior margins about 10 to 15% of total length; inner margins moderately long, at least half length of pectoral bases; interspace between pectoral and pelvic bases moderately long, slightly less than prespiracular length and about 11 to 14% of total length in adults; pelvic fins low and subangular; anal fin long, low, and angular, about five times longer than high, base slightly greater than prespiracular space and 16 to 18% of total length in adults; caudal fin fairly broad, with moderately enlarged denticles present along its dorsal margin. Lateral trunk denticles of body with flat, close-set crowns, body surface fairly smooth and not with a feltlike or fuzzy texture. Colour blackish, without conspicuous markings. Adults moderately large, to 51 cm.



Geographical Distribution: Western North Atlantic, northeastern Gulf of Mexico off Florida, USA, Gulf of Campeche, Mexico, Caribbean Panama, Caribbean Colombia, and off French Guiana.

Habitat and Biology: Found on the continental slope, on or near the bottom, at depths of 636 to 1115 m. One of the commonest Apristurus species in the Gulf of Mexico, along with A. laurussonii. Oviparous, apparently laying one egg per oviduct at a time.

Size: Maximum 52.1 cm for females, 47.6 cm for males.

Interest to Fisheries: Relatively common in deep trawl catches, but apparently not utilized commercially.

Literature: Springer (1966, 1979).

Remarks: Springer (1966) had originally termed this species A. indicus, but it is apparently not conspecific with that Indian Ocean species and was renamed by Springer & Heemstra (in Springer, 1979).

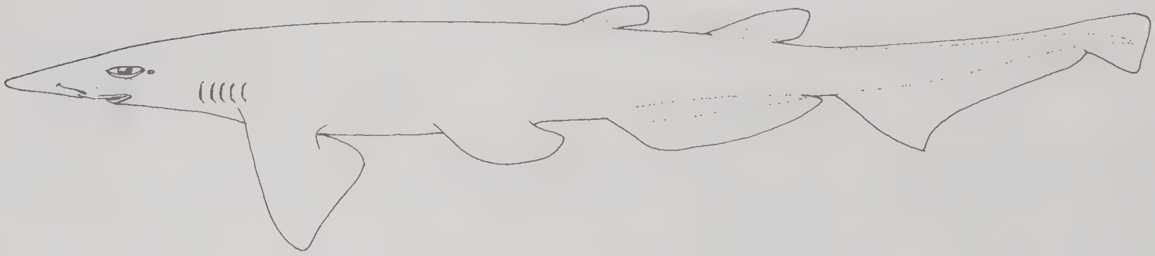
Apristurus platyrhynchus (Tanaka, 1909)

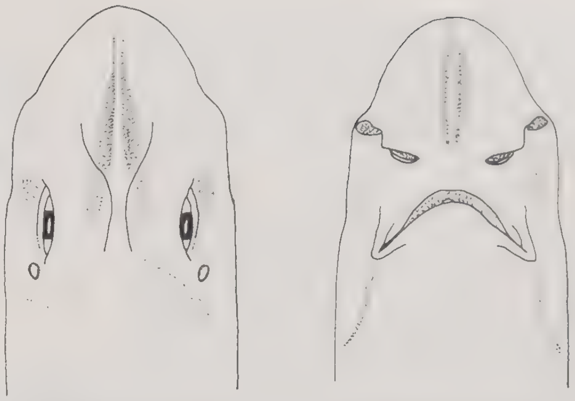
SCYL Aprist 17

Scyliorhinus platyrhynchus Tanaka, 1909, J.Coll.Sci.Imp.Univ.Tokyo, 23:4. Holotype: Imperial University collection, Tokyo, Japan, no. 2154, 800 mm male, presumably adult. Type Locality: Off Japan.

Synonymy: None.

FAO Names: En - Spatulasnout catshark; Fr - Holbiche spatule; Sp - Pejegato espatulado.



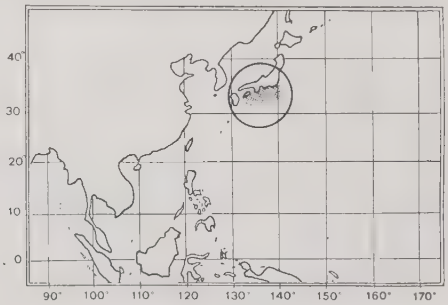


dorsal view of head

underside of head

Field Marks : One of several Apristurus with the first dorsal fin half area of second or less. See diagnostic features and key to species for further characters.

Diagnostic Features : Body relatively slender, trunk slightly tapering toward head. Snout moderately long, broad, and bell-shaped, preoral snout about 8% of total length; gill slits small, less than eye length; gill septa without projecting medial lobes or pleats, not strongly incised; eyes rather small in adults; about 3% of total length; nostrils broad, their width about 1.2 times internarial space; incurrent and excurrent apertures narrowly oval, anterior nasal flaps low and angular; mouth short, moderate-sized, and broadly arched, with dental bands little expanded and with lower one falling just behind uppers; mouth and labial furrows mostly below eyes; labial folds not enlarged, with lowers diagonal to body axis. Interdorsal space about twice first dorsal base, slightly less than preorbital snout; first dorsal fin about half as large as second, base of first about two-thirds length of second; origin of first dorsal posterior to pelvic insertions; second dorsal insertion well in front of anal insertion; pectoral fins moderate-sized, anterior margins about 14% of total length; inner margins long, nearly length of pectoral bases; interspace between pectoral and pelvic bases short, slightly less than prespiracular length and about 10% of total length in adults; pelvic fins fairly high and broadly rounded; anal fin long, low and subangular, about five times as long as high, base slightly greater than prebranchial space and 19% of total length in adults; caudal fairly broad, without a dorsal crest of enlarged denticles. Lateral trunk denticles of body with crowns flat and closely imbricating, surface smooth and without a feltlike or fuzzy texture. Colour probably dark, without conspicuous markings. Adults moderately large, adult female 64 cm.



Geographical Distribution : Western North Pacific: Japan (Honshu).

Habitat and Biology : A little-known deepwater species of the continental slopes. Oviparous, probably one egg per oviduct laid at a time.

Size : Maximum about 80 cm.

Interest to Fisheries : None at present.

Literature : Nakaya (1976); Springer (1979).

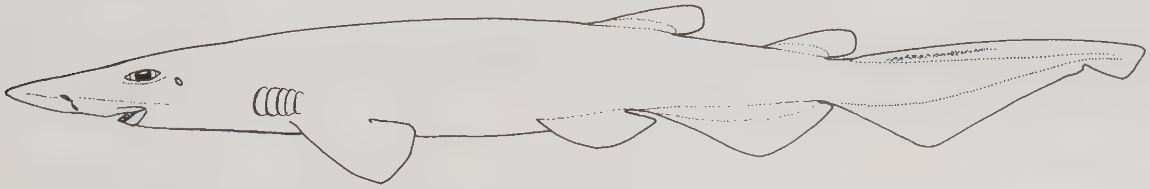
Apristurus profundorum (Goode & Bean, 1896)

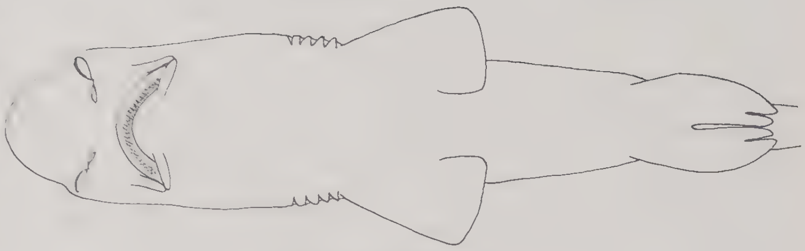
SCYL Aprist 18

Scylliorhinus profundorum Goode & Bean, 1896, Oceanic Ichthyol., Smithson.Inst., Spec.Bull., 17, pl. 5, fig. 16. Holotype: U.S. National Museum of Natural History, USNM 35646, 510 mm adolescent male. Type Locality: Off Delaware Bay, in 1492 m depth.

Synonymy : None.

FAO Names : En - Deepwater catshark; Fr - Holbiche papoila; Sp - Pejegato abisal.

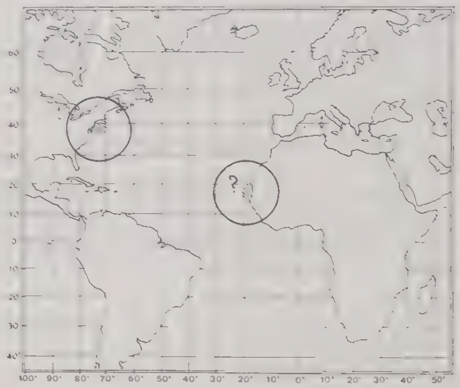




partial ventral view

Field Marks : Thick snout, anteriorly extended mouth with expanded dental bands, rather large gill slits, narrow internarial, erect denticles and fuzzy skin texture, high rounded fins, caudal crest.

Diagnostic Features : Body relatively slender, trunk slightly tapering toward head. Snout moderately long, very broad, and bell-shaped, preoral snout about 9% of total length; gill slits moderately large but longest somewhat less than eye length; gill septa without projecting medial lobes or pleats, but well-incised; eyes rather small, about 3% of total length; nostrils broad, their width about equal to internarial space; incurrent and excurrent apertures rather narrowly oval, anterior nasal flaps low and broadly triangular; mouth moderately long, large, and broadly arched, with dental bands partly expanded and with lower ones falling just behind uppers; mouth and labial furrows extending well in front of eyes; labial folds somewhat enlarged, with lower nearly transverse to body axis. Interdorsal space slightly greater than first dorsal base, about two-thirds of preorbital snout; first dorsal fin about as large as second, bases about equally long; origin of first dorsal slightly behind pelvic midbases; second dorsal insertion about opposite anal insertion; pectoral fins rather small, anterior margins about 11% of total length; inner margins fairly long, about half length of pectoral bases; interspace between pectoral and pelvic bases moderately long, slightly less than prespiracular length and about 15% of total length; pelvic fins high and broadly rounded; anal fin moderately long, fairly high, and subangular, short, high and rounded, slightly more than three times as long as high, its base slightly greater than prespiracular space and 14% of total length; caudal fin fairly broad, with a well-developed crest of enlarged denticles on dorsal caudal margin, with crest denticles directed obliquely downward. Lateral trunk denticles of body with crowns partly erect, giving skin surface a feltlike or fuzzy texture. Colour brownish, probably dark brown in life. Adults moderately large, as adolescent male is 51 cm long.



Geographical Distribution : Western North Atlantic: Off Delaware Bay (Atlantic coast of USA). ? Eastern North Atlantic: Mauritania.

Habitat and Biology : A poorly-known species, from the western Atlantic continental slopes at 1492 m; depth range in the eastern North Atlantic (if this species and not A. manis) 1300 to 1600 m.

Size : Adolescent at 51 cm, maximum unknown.

Interest to Fisheries : None.

Literature : Bigelow & Schroeder (1948); Springer (1966, 1979); Golovan (1976, 1978).

Remarks : This catshark is only known for certain from the badly preserved holotype, which is here illustrated from original drawings by the writer. Springer (1966) had previously mistaken another species for A. profundorum, but later (1979) redescribed it as Parmaturus manis. This was supposed to differ from A. profundorum in having a caudal crest of enlarged denticles, but examination of the holotype of A. profundorum showed that it too has a noticeable caudal crest.

It is uncertain whether eastern Atlantic records of A. profundorum by Golovan (1976, 1978) are this species or A. manis.

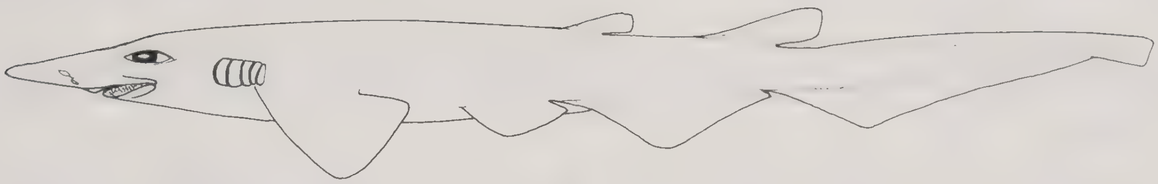
Apristurus riveri Bigelow & Schroeder, 1944

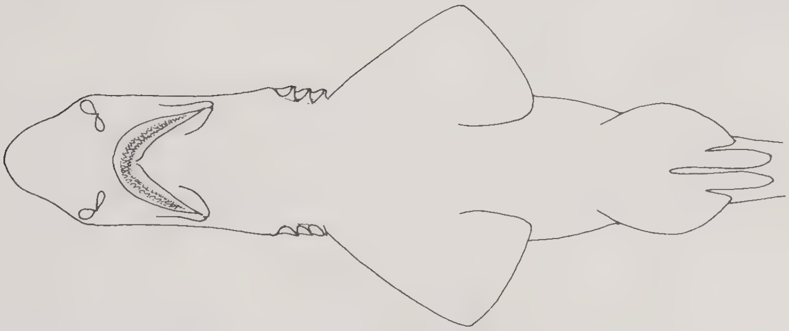
SCYL Aprist 19

Apristurus riveri Bigelow & Schroeder, 1944, Proc.New England Zool.Club, 23:23, pl. 7. Holotype: Museum of Comparative Zoology, Harvard, MCZ 36092, 407 mm female. Type Locality: North coast of Cuba, 23°24'N, 80°44'W, western North Atlantic, at 1061 m.

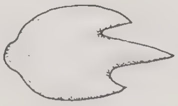
Synonymy : None.

FAO Names : En - Broadgill catshark; Fr - Holbiche grandes oreilles; Sp - Pejegato agallón.





partial ventral view

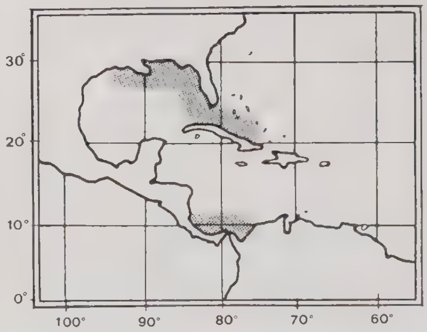


dermal denticle

Field Marks : An Apristurus with a slender body, broad internarial, large gill slits, long anteriorly expanded mouth, first dorsal fin half area of second, moderately high and angular anal fin, narrow caudal fin, dark coloration with unmarked fins.

Diagnostic Features : Body relatively slender, trunk slightly tapering toward head. Snout moderately long, rather narrow, and bell-shaped, preoral snout about 7 to 10% of total length; gill slits large, the longest 2/3 to slightly greater than eye length; gill septa without projecting medial lobes or pleats, but well-incised; eyes small in adults, about 3 to 4% of total length; nostrils narrow, their width about 1.4 to 1.7 times in internarial space; incurrent and excurrent apertures broadly oval, anterior nasal flaps high and angular; mouth long (especially in adult males), large, and broadly arched, with dental bands prominently expanded and with lower ones falling well behind uppers; mouth and labial furrows extending well in front of eyes; labial folds somewhat enlarged, with lower diagonal to nearly transverse to body axis; mouth and teeth greatly enlarged in males. Interdorsal space almost or quite twice first dorsal base, half to two-thirds of preorbital snout; first dorsal fin half area of second or less, base of first about two-thirds the length of second; origin of first dorsal over rear half of pelvic bases; second dorsal insertion over or in front of anal insertion; pectoral fins rather small, anterior margins about 10 to 12% of total length; inner margins moderately long, half to two-thirds length of pectoral bases; interspace between pectoral and pelvic bases moderately short, somewhat less than preorbital length and about 9 to 12% of total length in adults; pelvic fins fairly low and rounded or subangular; anal fin fairly long, moderately high, and angular, about four times as long as high, base slightly less than or greater than prespiracular space and 13 to 16% of total length in adults; caudal fin narrow, without a developed crest of enlarged denticles on dorsal caudal margin, though denticles there are slightly enlarged. Lateral trunk denticles of body with crowns close-set and partly erect, giving the skin surface a feltlike or fuzzy texture. Colour dark brown, without conspicuous markings. Adults small, to 48 cm.

Geographical Distribution : Western North Atlantic: Cuba, northern Gulf of Mexico, Panama.



Habitat and Biology : An uncommon catshark of the western Atlantic continental slopes on or near bottom at 860 to 1098 m depth. Oviparous, with one egg per oviduct laid at a time. This shark has sexual dimorphism unusually well-developed in adults, with the males having much larger conical teeth without cusplets (cusplets present in females) and much longer and wider mouths and jaws than females. Springer (1979) interpreted this as a male adaption for grasping females in courtship and copulation, and suggested that the enlarged conical teeth of males would do less damage than smaller teeth with cusplets. It is uncertain, however, why one species of Apristurus has sexual heterodonty (and 'heterognathy') so strongly developed, while others that may live in the same habitat alongside it do not.

Size : Maximum 46 cm, adult males 43 to 46 cm, adult females 40 to 41 cm.

Interest to Fisheries : None.

Literature : Bigelow & Schroeder (1944, 1948); Springer (1966, 1979).

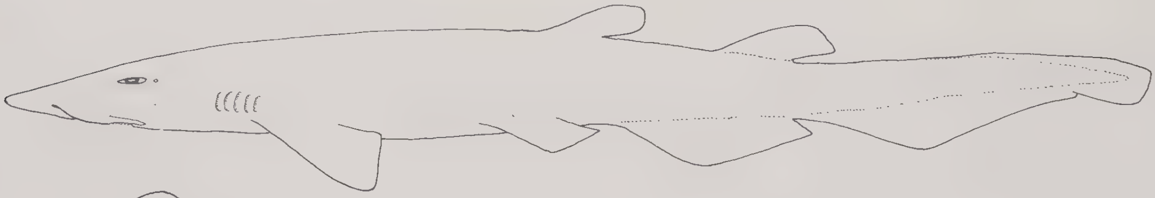
Apristurus saldanha (Barnard, 1925)

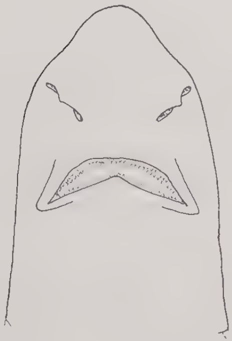
SCYL Aprist 20

Scylliorhinus saldanha Barnard, 1925, *Ann.S.Afr.Mus.*, 2(1):44. Holotype: Apparently lost. Type Locality: Off Saldanha Bay, South Africa, 915 m depth.

Synonymy : None.

FAO Names : En - Saldanha catshark; Fr - Holbiche gatussau; Sp - Pejegato saldaña.





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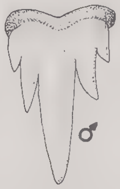
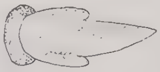


tooth

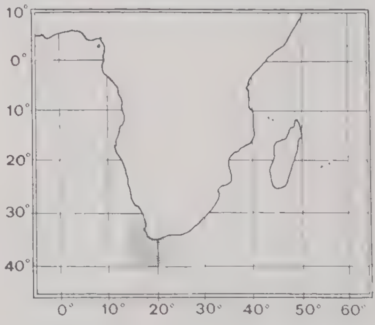


dermal denticle

Field Marks : A poorly known *Apristurus* said to differ from other species in its very long interdorsal space, equal to the prespiracular head.

Diagnostic Features : Snout moderately long, preoral snout about 7% of total length; gill slits probably small, less than eye length; gill septa without projecting medial lobes; eyes rather small in adults, about 2.6% of total length; mouth possibly short and broadly arched, with dental bands not prominently expanded, and with lower ones falling well behind uppers; mouth and labial furrows possibly under eyes; labial furrows possibly not expanded. Interdorsal space considerably greater than first dorsal base, about equal to prespiracular space; first dorsal fin slightly smaller in area than second; origin of first dorsal about over pelvic midbases; insertion of second dorsal opposite anal insertion; anal fin long, its base about equal to prebranchial space in adults. Lateral trunk denticles probably flat. Colour slate-grey. Adults large, 81 cm.

Geographical Distribution : Eastern South Atlantic: Southwestern Cape Province, South Africa.



Habitat and Biology : A poorly-known catshark of the continental slope of South Africa, type taken at 915 m depth and other, doubtfully referred specimens at 402 to 1000 m.

Size : Maximum 81 cm.

Interest to Fisheries : None.

Literature : Barnard (1925); Bass, d'Aubrey & Kistnasamy (1975); Springer (1979).

Remarks : Barnard's (1925) original description of this species was brief and not illustrated. Bass, d'Aubrey & Kistnasamy (1975a) described three small specimens (the largest 44 cm) from off Saldanha, South Africa in the British Museum (Natural History) which they ascribed to this species, but Springer (1979) thought that the relatively narrow interdorsal spaces (considerably shorter than the prespiracular head) of these specimens did not fit *A. saldanha*. However, a larger specimen (56 cm) from the same locality recently taken by a Soviet research vessel had a long interdorsal space about equal to the prespiracular head and may be this species (G. Golovan *in* Springer, 1979). As Barnard's original specimen was quite large, the possibility remains that the difference between it and the BM(NH) specimens are a matter of allometry in a single species. One of the BM(NH) specimens is illustrated above (after Bass, D'Aubrey & Kistnasamy, 1975a).

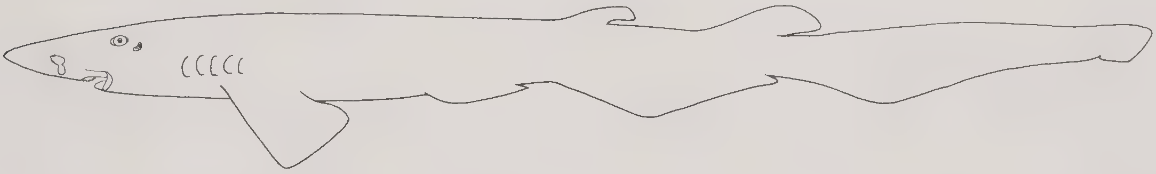
Apristurus sibogae (Weber, 1913)

SCYL Aprist 21

Scyliorhinus sibogae Weber, 1913, Siboga-Exped.Fische, 57:593. Holotype: Zoologisches Museum, Amsterdam, ZMA 111076, 210 mm immature female. Type Locality: 0°32'S, 119°39.8'E, Makassar Straits, 655 m depth.

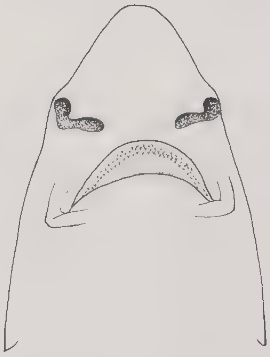
Synonymy : None.

FAO Names : En - Pale catshark; Fr - Holbiche pâle; Sp - Pejegato paliducho.



Field Marks : A reddish-white slender Apristurus with very small eyes, narrow, relatively short, pointed snout, anteriorly expanded mouth, first dorsal fin less than half area of first and with its origin well behind pelvic bases, and low, narrow anal and caudal fins.

Diagnostic Features : Body relatively slender, trunk slightly tapering toward head. Snout moderately long, narrow, and pointed, preoral snout about 8% of total length; gill slits small but about equal to eye length; gill septa without projecting medial lobes or pleats, but with deeply incised edges; eyes extremely small, about 1.7% of total length; nostrils narrow, their width about 1.3 times in internarial space; incurrent and excurrent apertures large and oval, anterior nasal flaps large and triangular; mouth moderately long, large, and broadly arched, with dental bands prominently expanded and with lower ones falling well behind uppers; mouth and labial furrows extending well in front of eyes; labial folds somewhat enlarged, with lower nearly transverse to body axis. Interdorsal space nearly twice the first dorsal base, slightly less than preorbital snout; first dorsal fin only about a third as large as second, base of second nearly twice as long as first; origin of first dorsal posterior to free rear tips of pelvics; second dorsal insertion behind anal insertion; pectoral fins small, anterior margins 9% of total length; inner margins long, nearly length of pectoral bases; interspace between pectoral and pelvic bases fairly short, slightly less than prespiracular length and about 11% of total length; pelvic fins very low and subquadrate; anal fin long, low, and angular, over 5 times as long as high, its base about equal to prepectoral space and 18% of total length in the type; caudal fin very long and narrow, presence of caudal crest of denticles uncertain. Condition of lateral trunk denticles uncertain. Colour reddish-white. Size of adults uncertain, only specimen 21 cm.



underside of head

Geographical Distribution : Western South Pacific: Makassar Straits between Borneo and Sulawesi (Indonesia).

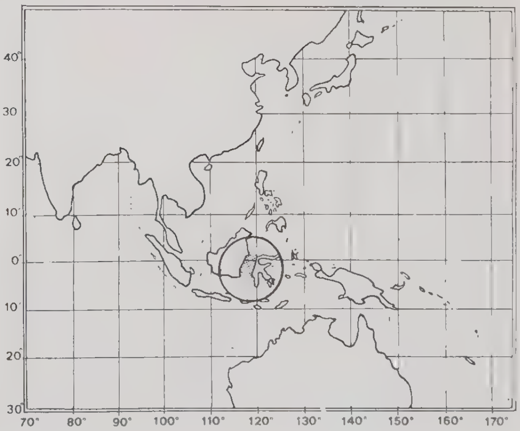
Habitat and Biology : A rare catshark, only known from the Makassar Straits slope at 655 m depth.

Size : Maximum over 21 cm (juvenile).

Interest to Fisheries : None.

Literature : Fowler (1941); Springer (1979).

Remarks : The present account and illustration is based on the writer's examination of the holotype and only known specimen. Although very small and in rather poor condition, it evidently represents a very distinct species.



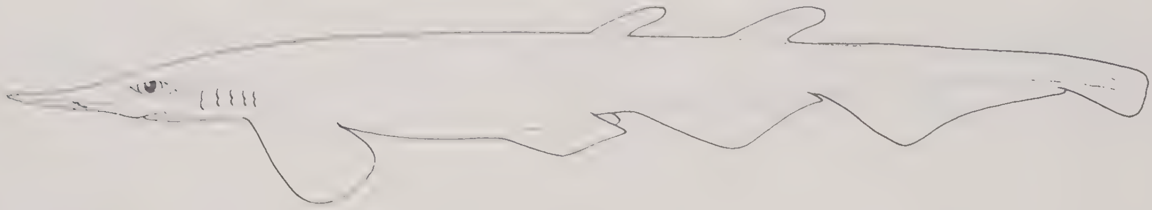
Apristurus sinensis Chu & Hu, 1981

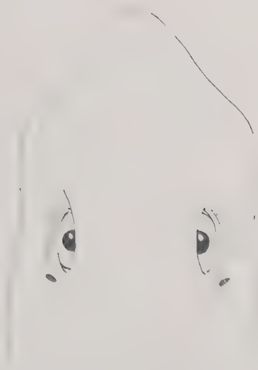
SCYL Aprist 22

Apristurus sinensis Chu & Hu, *in* Chu *et al.*, 1981, *Oceanolog.Limnolog.Sinica*, 12(2):103, fig. 1. Holotype: South China Sea Fisheries Research Institute, SCSFRS 00099, 417 mm, immature or adolescent male. Type Locality: South China Sea (off China ?) 537 m depth.

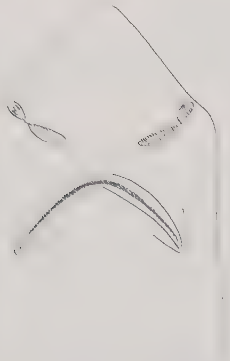
Synonymy : None.

FAO Names : En - South China catshark; Fr - Holbiche chuhu; Sp - Pejegato chino.





dorsal view of head



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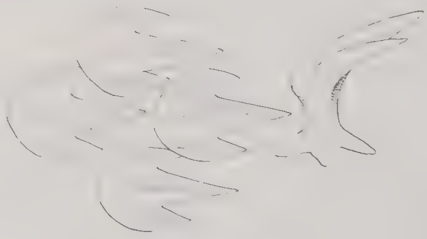
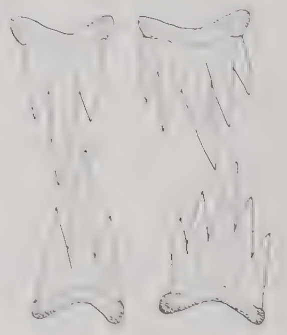


dermal denticles



upper and lower teeth

Field Marks : An *Apristurus* with a pointed, angular prenasal snout, gill septa with short medial projections, first dorsal fin about half as large as second and with its origin over last quarter of pelvic bases.

Diagnostic Features : Body relatively slender, trunk moderately tapering toward head. Snout moderately long, basally broad but distally pointed and angular, preoral snout about 10% of total length; gill slits moderate-sized, somewhat less than eye length; gill septa with small projecting medial lobes, without pleats and incised margins; eyes small in adults, about 3% of total length; nostrils broad, their width about equal to internarial space; incurrent and excurrent apertures fairly large and oval, anterior nasal flaps low and angular; mouth moderately long and large, broadly arched, with dental bands hardly expanded and with lower ones falling just behind uppers; mouth and labial furrows extending little in front of eyes; labial folds not enlarged, with lowers diagonal to body axis; mouth and teeth probably not enlarged in males. Interdorsal space about twice the first dorsal base, slightly less than preorbital snout; first dorsal fin about half as large as second, base of first dorsal about two-thirds of second; origin of first dorsal opposite last fourth of pelvic bases; second dorsal insertion well in front of anal insertion; pectoral fins rather small, anterior margins about 12% of total length; inner margins moderately long, about half the length of pectoral bases; interspace between pectoral and pelvic bases moderately long, slightly less than prebranchial length and about 16% of total length; pelvic fins low and subangular; anal fin long, fairly high, and angular, about four times as long as high, its base about equal to prebranchial space and about 17% of total length; caudal fin moderately broad but somewhat elongated, presence of dorsal crest of enlarged denticles uncertain. Lateral trunk denticles of body with crowns partly elevated and close-set, skin surface possibly with a feltlike or fuzzy texture. Colour dark, with no conspicuous markings. Adult size unknown.

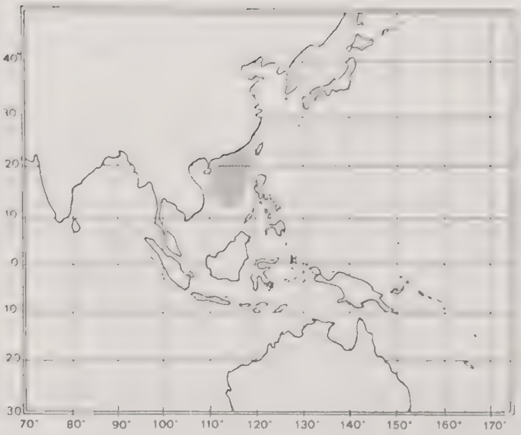
Geographical Distribution : Known only from the type locality, the South China Sea (off the Chinese coast?) in 537 m depth.

Habitat and Biology : A poorly known catshark from the South China Sea in 537 m depth, presumably caught on or near the bottom.

Size : The holotype and only known specimen is a 41.7 cm immature or adolescent male, so the species presumably reaches at least 50 cm or more total length.

Interest to Fisheries : None.

Literature : Chu et al. (1981).



Apristurus spongiceps (Gilbert, 1895)

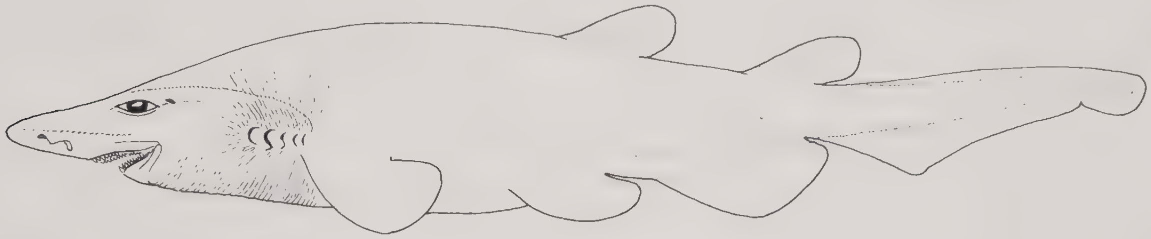
SCYL Aprist 23

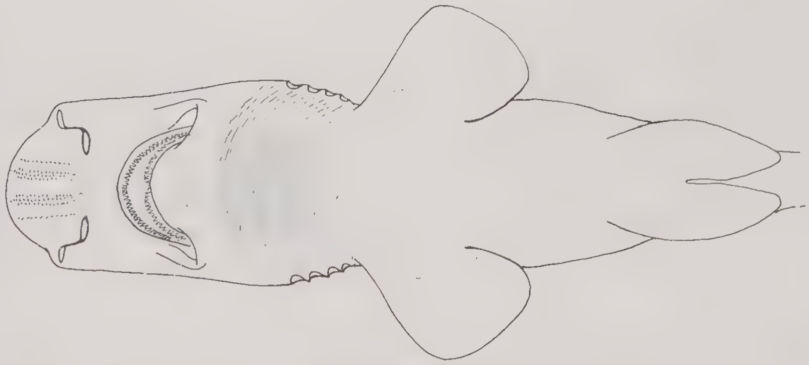
Catulus spongiceps Gilbert, 1895, Bull.U.S.Fish Comm., 23(sect. 2):579. Holotype: U.S. National Museum of Natural History, USNM 51590, 500 mm adult female. Type Locality: Central Pacific, near Bird Island, Hawaiian Islands, 572 to 1462 m depth.

Synonymy : None.

Other Scientific Names Recently in Use : Pentanchus spongiceps (see Fowler, 1941); Parapristurus spongiceps (see Springer, 1979).

FAO Names : En - Spongehead catshark; Fr - Holbiche tête molle; Sp - Pejegato esponjoso.

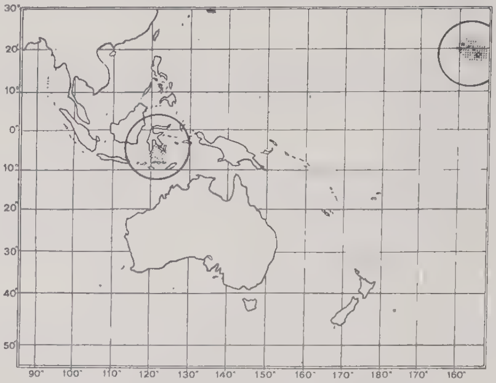




partial ventral view

Field Marks : A thick-bodied, thick-headed Apristurus with pleats and grooves on the branchial region, high rounded fins, and no caudal crest.

Diagnostic Features : Body stout, trunk slightly tapering toward head. Snout moderately long and broadly rounded, preoral snout about 9% of total length; gill slits very small, much less than eye length; gill septa without projecting medial lobes and slightly incised, but covered with unique pleats and folds that extend above the gill slits and onto the throat; eyes rather small in adults, about 3% of total length; nostrils broad, their width about equal to internarial space; incurrent and excurrent apertures rather narrow and slitlike, anterior nasal flaps large and triangular; mouth long, large, and broadly arched, with dental bands prominently expanded and with lower ones falling far behind uppers; mouth and labial furrows extending well in front of eyes; labial folds enlarged, with lowers nearly transverse to body axis. Interdorsal space slightly greater than first dorsal base, slightly less than preorbital snout; first dorsal fin about as large as second, bases about equally long; origin of first dorsal slightly anterior to pelvic midbases; second dorsal insertion behind anal insertion; pectoral fins rather small, anterior margins about 11% of total length; inner margins long, two-thirds length of pectoral bases; interspace between pectoral and pelvic bases short, slightly greater than preorbital length and about 11% of total length in adults; pelvic fins high and broadly rounded; anal fin short, high, and rounded, slightly more than twice as long as high, its base slightly greater than the prespiracular space and 13% of total length in adults; caudal fin moderately broad, without a dorsal crest of enlarged denticles. Lateral trunk denticles of body with crowns erect and fairly close-set, skin surface with a feltlike or fuzzy texture. Colour dark brown, without conspicuous markings on fins. Adults moderately large, adult female 50 cm.



Geographical Distribution : Central Pacific: Hawaiian Islands. Western South Pacific: Banda Sea off southern Sulawesi.

Habitat and Biology : A rare shark known from two specimens taken on the insular slopes, on or near the bottom at 572 to 1482 m depth. Probably oviparous; the holotype is a gravid female.

Size : The holotype was adult at 50 cm.

Interest to Fisheries : None.

Literature : Fowler (1934, 1941); Springer (1979).

Remarks : The above diagnosis and illustration is based on the writer's examination of the holotype. Weber (1913) referred a 105 mm juvenile Apristurus from the Banda Sea to this species, which was accepted by Fowler (1941) and Springer (1979). The writer examined this specimen in the collections of the Zoologisck Museum of Amsterdam (ZMA 111.403, Banda Sea, 5°40.7'S, 120°45.5'E, 1158 m depth). Although much smaller and slenderer than the holotype, it is generally similar and has the same unique pleated gills; and is placed in A. spongiceps despite the great distance between the two localities. Springer (1979) included this species in a separate genus, Parapristurus, but I follow Fowler (1941) and Bigelow & Schroeder (1948) in retaining it in Apristurus (see remarks under genus Apristurus for a discussion of this problem).

Apristurus stenseni (Springer, 1979)

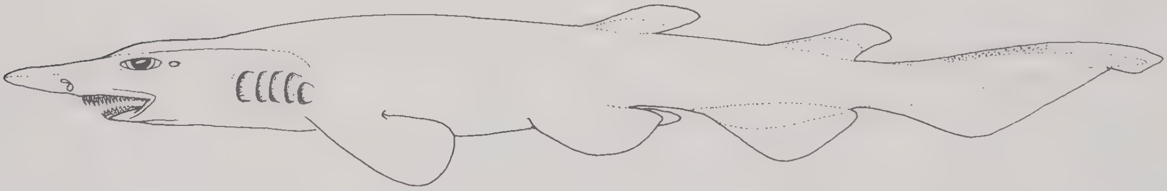
SCYL Aprist 24

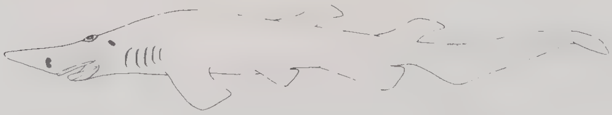
Parmaturus stenseni Springer, 1979, NOAA Tech.Rep.NMFS Circ., (422):104, figs 64-66. Holotype: Universitetets Zoologiske Museum, Copenhagen, Denmark, ZMK Galathea 739-1, 185 mm immature male. Type Locality: 07°22'N, 79°32'W, Gulf of Panama, eastern North Pacific, 915 to 975 m.

Synonymy : None.

Other Scientific Names Recently in Use : Parmaturus stenseni Springer, 1979.

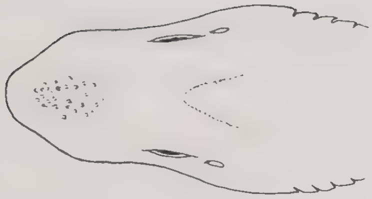
FAO Names : En - Panama ghost catshark; Fr - Holbiche nébuleuse; Sp - Pejegato panameño.



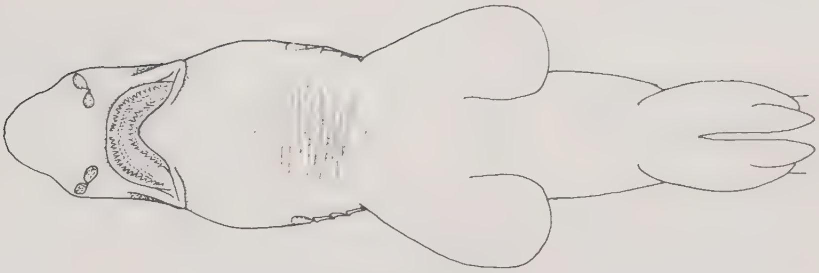


holotype, after Springer (1979)

Field Marks : A slender, very small-eyed Apristurus with very large gill slits, a broad internarial and small nostrils, an extremely large, anteriorly expanded mouth, first dorsal origin about over pelvic midbases, an anal fin between 3 and 4 times as long as high, dark coloration with no conspicuous markings, and a long, low caudal fin with a prominent dorsal crest of denticles.



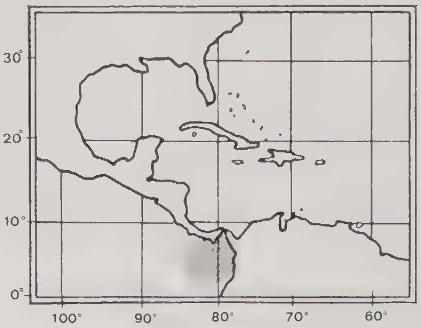
dorsal view of head



partial ventral view

Diagnostic Features : Body relatively slender, trunk slightly tapering toward head. Snout moderately long, broad, bell-shaped, and slightly pointed, preoral snout about 5 to 8% of total length; gill slits very large, somewhat greater than eye length; gill septa without projecting medial lobes or pleats and apparently not incised; eyes rather small, between 2 and 3% of total length; nostrils narrow, their width about 1.8 times in internarial space; mouth long, large, and broadly arched, with dental bands prominently expanded and with lower ones falling well behind uppers; mouth and labial furrows extending well in front of eyes; labial folds somewhat enlarged, with lower nearly transverse to body axis. Interdorsal space nearly or quite twice the first dorsal base, slightly less than preorbital snout; first dorsal fin slightly smaller than second, base of first about 3/4 the length of second; origin of first dorsal about over pelvic midbases; second dorsal insertion behind anal insertion; pectoral fins rather small, anterior margins about 6 to 13% of total length; inner margins long, nearly length of pectoral bases; interspace between pectoral and pelvic bases moderately long, slightly less or greater than prespiracular length and about 10 to 13% of total length; pelvic fins high and angular; anal fin short, fairly high, and rounded, between 3 and 4 times as long as high, its base about equal to prespiracular space and 10 to 15% of total length; caudal fin very long and narrow (in young at least), a well-developed crest of enlarged denticles on dorsal caudal margin. Lateral trunk denticles of body with crowns unicuspid, needle-like, and wide-spaced, surface probably with a feltlike or fuzzy texture. Colour blackish, without conspicuous markings on fins. Adult size unknown.

Geographical Distribution : Eastern North Pacific: Pacific Panama from Gulf of Panama and Panama Bay.



Habitat and Biology : A poorly known shark of the eastern Pacific continental slope, found at 915 to 975 m depth.

Size : Maximum over 23 cm; males may mature at or above 20.8 cm total length.

Interest to Fisheries : None.

Literature : Springer (1979).

Remarks : The account of this species is based on Springer (1979). This shark is close to A. kampae but apparently distinguishable from it by several characters (see key to species). It also closely resembles an Apristurus known from adult sharks taken off the Galapagos Islands and Peru. These also have a dorsal crest of denticles and might be conspecific with A. stenseni, but differ in having smaller gills and larger eyes, a short, broader caudal fin, a less anteriorly expanded mouth, and a more domed head. They may also represent a new species.

Springer (1979) placed this species in the genus Parmaturus, subgenus Compagnoia, along with his new P. manis. These are transferred to Apristurus (see remarks under genus Apristurus).

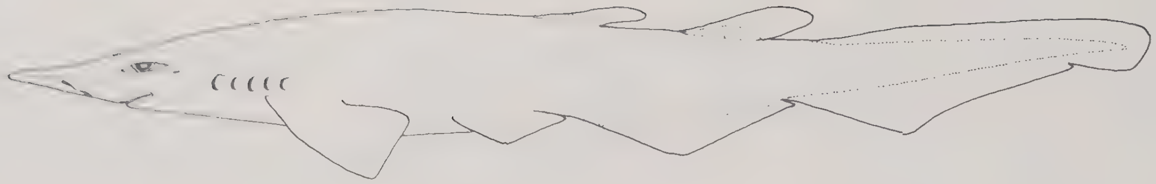
Apristurus verweyi (Fowler, 1934)

SCYL Aprist 25

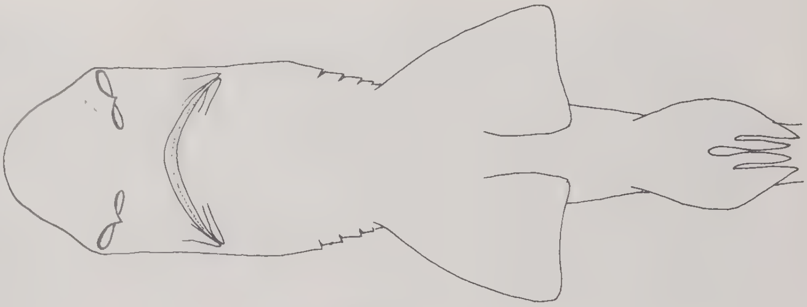
Pentanchus verweyi Fowler, 1934, Proc.Acad.Nat.Sci.Philad., 85:237, fig. 2. Holotype: U.S. National Museum 93135, 297 mm immature male. Type Locality: 4°10.5'N, 118°37.1'E, Sipadan Island, vicinity of Sibuko Bay, southern Sulawesi.

Synonymy : None.

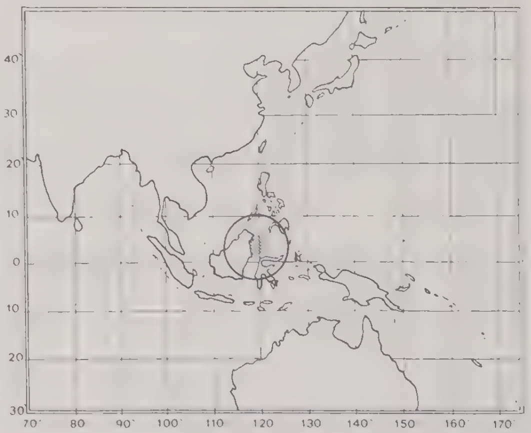
FAO Names : En - Borneo catshark; Fr - Holbiche malaise; Sp - Pejegato de Borneo.



Field Marks : One of several Apristurus with the first dorsal fin half the area of the second or less. For other characters see diagnostic features and key to species.


partial ventral view

Diagnostic Features : Body slender, tapering gradually to head. Snout long, very broad, and bell-shaped, preoral snout about 11% of total length; gill slits small, much less than eye length; gill septa without projecting medial lobes or pleats but deeply incised; eyes small, about 4% of total length; nostrils broad, their width about equal to internarial space; incurrent and excurrent apertures small and oval, anterior nasal flaps low and angular; mouth short, moderately large, and very broadly arched, with dental bands not expanded and with lower ones falling just behind uppers; mouth and labial furrows below eyes; labial folds not enlarged, with lowers diagonal to body axis. Interdorsal space about a third greater than first dorsal base, two-thirds of preorbital snout; first dorsal fin about half the area of second, base of first about three-fourths the length of second; origin of first dorsal slightly behind pelvic insertions; second dorsal insertion well in front of anal insertion; pectoral fins rather small, anterior margins about 12% of total length; inner margins long, nearly length of pectoral bases; interspace between pectoral and pelvic bases short, slightly less than preorbital length and about 10% of total length; pelvic fins low and angular; anal fin moderately long, low and angular, slightly more than 4 times as long as high, its base about equal to prebranchial space and 18% of total length; caudal fin elongated and fairly broad, without a crest of enlarged denticles on dorsal caudal margin. Lateral trunk denticles of body with crowns fairly flat and close-set, surface fairly smooth and not with a feltlike or fuzzy texture. Colour dark brown without conspicuous white margins on fins. Adult size unknown.



Geographical Distribution : Known only from the type locality (Sipadan Island, vicinity of Sibuko Bay, southern Sulawesi (Celebes).

Habitat and Biology : A rare, deepwater catshark, known only from the holotype.

Size : Over 29.7 cm maximum.

Interest to Fisheries : None.

Literature : Fowler (1934, 1941); Springer (1979).

Remarks : The above account and illustration is based on the writer's examination of the holotype. Springer (1979) noted that this species may be a synonym of A. platyrhynchus, but hesitated to synonymize it; A. verweyi is provisionally retained here.

Asymbolus Whitley, 1939

SCYL Asym

Genus : *Asymbolus* Whitley, 1939, *Aust.Zool.*, 9(3):229.

Type Species : *Scyllium anale* Ogilby, 1885, by original designation.

Synonymy : Genus *Juncrus* Whitley, 1939 (see remarks below).

Diagnostic Features : Body not tadpole-shaped, slender and cylindrical, tapering slightly to caudal fin; body firm and thick skinned, with well-calcified dermal denticles; stomach not inflatable; tail moderately long, length from vent to lower caudal origin about 2/3 to nearly equal snout-vent length. Head slightly depressed, narrowly pointed-rounded in lateral view and not wedge-shaped; head short, less than 1/5 of total length in adults; snout short to slightly elongated, less than 5/6 of mouth width, thick, and slightly flattened, bluntly pointed in lateral view; snout not expanded laterally, rounded-parabolic and slightly bell-shaped in dorsoventral view; ampullal pores not greatly enlarged on snout; nostrils of moderate size, with incurrent and excurrent apertures only partly open to exterior; anterior nasal flaps formed as triangular lobes, without barbels, well separate from each other and falling somewhat anterior to mouth; internarial space 0.6 to 1 times the nostril width; no nasoral grooves; eyes dorsolateral on head, narrow subocular ridges present below eyes; mouth angular to arched, moderately long, with lower symphysis well behind upper so that upper teeth are exposed in ventral view; labial furrows present along both upper and lower jaws, these short and ending well behind level of upper symphysis of mouth; branchial region not greatly enlarged, distance from spiracles to fifth gill slits about half the head length; gill slits lateral on head. Two dorsal fins present, about equal-sized; origin of first dorsal over or slightly behind the pelvic insertions; origin of second dorsal varies from about over the anal midbase to over the rearmost third of its base; anal fin moderately large but not greatly elongated, about as large as pelvic fins and larger than dorsals, its base length 1.4 to 1.8 times the second dorsal base; pectoral fins moderately large, their width about equal to or slightly greater than mouth width; inner margins of pelvic fins fused over claspers and forming an 'apron' in adult males; claspers moderately long to very long, fairly thick to slender, and distally blunt or pointed, extending about half of their lengths or more behind the pelvic fin tips; origin of anal far behind pelvic bases, and insertion separated from lower caudal origin by a broad space over half the anal base; caudal fin short and broad, less than a fifth of total length in adults. No crests of denticles on the caudal margins; supraorbital crests absent from cranium. Colour light to dark brown above, light below, with a simple colour pattern of scattered white or dark spots on the sides and dorsal surface, and sometimes dark spots on the underside of head.

Remarks : Whitley (1939) named two new genera for Australian catsharks, *Asymbolus* for *Scyllium anale* Ogilby, 1885, and *Juncrus* for *Scyllium vincenti* Zeitz, 1908. Fowler (1941) retained these species in the genus *Halaelurus*, but Whitley (1939, 1940) distinguished his genera by the basally fused pelvic inner margins in adult males, which form an 'apron' over the claspers. Apart from coloration, Whitley offered little to distinguish the two genera from each other. Springer (1979) revived *Asymbolus* and *Juncrus*, but distinguished them only by relative clasper length in males, very long and slender in *Juncrus vincenti* and shorter and thicker in *Asymbolus analis*; and by the form of the 'apron' over the claspers (Springer, 1979:96).

Recently, much new material of *Asymbolus-Juncrus* catsharks has been collected off Australia, and is being studied by Dr John Stevens and the writer. There are at least two undescribed species in this material, which confound Springer's generic criteria. There is an *analis*-like new species that has *vincenti*-like elongated claspers, and a *vincenti*-like new species with *analis*-like short claspers. Comparison of *analis*-like catsharks with *vincenti*-like species revealed little difference in the form of the pelvic 'apron' of adult males of various species, and suggests nothing of significance to separate these sharks in different genera. Hence the genus *Juncrus* is synonymized with *Asymbolus* (mentioned before *Juncrus* in Whitley, 1939:229).

From the spotted species of *Halaelurus*, *Asymbolus* species additionally differ in their much narrower and less flattened heads, their nearly lateral eyes, lateral (rather than dorsolateral) gill slits, and more narrowly parabolic, bluntly rounded snouts (broader, often angular and pointed snouts in spotted *Halaelurus*). Possibly these differences are only worthy of subgeneric ranking within *Halaelurus*, but *Asymbolus* is retained for the southern Australian spotted catsharks (which almost certainly form a natural, monophyletic group) until relationships of the *Halaelurus* species are clarified.

Springer (1979) noted that Tasmanian and Australian mainland *A. analis* may be distinct, the Tasmanian form being considerably smaller (adult male 37 cm, *versus* mainland males immature at up to 51 cm and adult at 55 cm). In examining *Asymbolus* material the writer has seen such small, *analis*-like specimens, as well as the larger *analis* proper (including the holotype). However, whatever the status of these small *analis*-like sharks, there is definitely a new *analis*-like species that differs from *analis* in having numerous small black spots on its body and the underside of its head, in having enlarged teeth in males, and in being smaller. This will be described by Dr John Stevens and the writer.

Springer (1979) also noted that *vincenti* material examined by him was heterogeneous, and, while including it in a single species, noted that more material was necessary to determine if it represented more than one species. Apparently an additional new species of *vincenti*-like catshark exists, separable from typical *vincenti* in having a much lighter ground colour, larger and fewer light spots, shorter, thicker, pointed claspers, and in being considerably smaller.

Key to Species :

1a. Colour light brown with obscure dusky saddles and scattered large dark rusty spots on back and fins. Claspers short, fairly thick, and terminally pointed .... A. analis

1b. Colour mottled chocolate brown above, white below, with numerous small white spots on back and fins. Claspers long, very slender, and terminally blunt .... A. vincenti

Asymbolus analis (Ogilby, 1885)

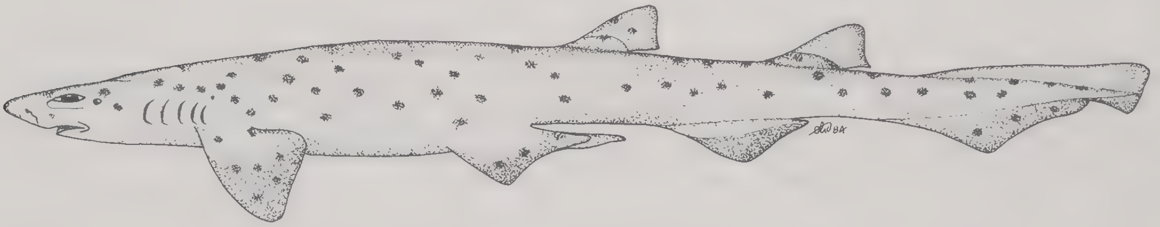
SCYL Asym 1

Scyllium anale Ogilby, 1885, Proc.Linn.Soc.New S.Wales, 10:445. Holotype: Australian Museum, Sydney, AMS B.8447, 569 mm adult male. Type Locality: Port Jackson Harbour, New South Wales, Australia.

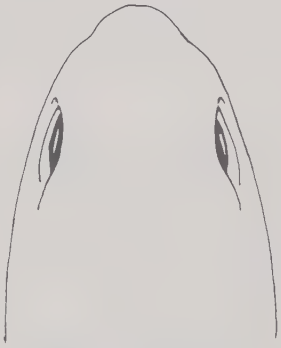
Synonymy : None.

Other Scientific Names Recently in Use : Halaelurus analis (Ogilby, 1885).

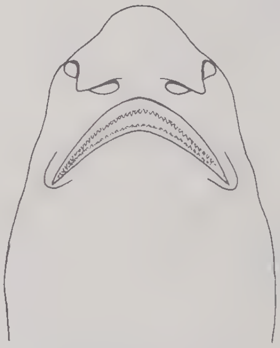
FAO Names : En - Australian spotted catshark; Fr - Chien tacheté; Sp - Pejegato de lunares.



Field Marks : Simple colour pattern of large, widespaced rusty brown spots and obscure dark saddles on a light brown background, head rather narrow and not greatly flattened, snout narrowly parabolic, short, and rounded but not pointed or upturned, nostrils well separated from each other and from mouth, without nasoral grooves, eyes close to horizontal head rim, gill slits lateral, labial furrows short but present on both jaws, claspers of males with apron formed from fused pelvic inner margins, dorsal fins equally large, with origin of first over or behind pelvic insertions, anal fin somewhat larger than second dorsal fin and with its base partly in front of second dorsal base, no supracaudal crests of denticles, cranium without supraorbital crests.



dorsal view of head

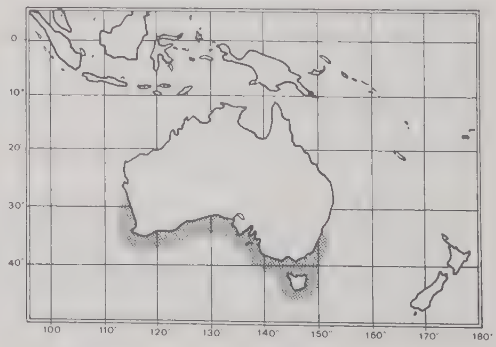


underside of head

Diagnostic Features : Snout more rounded. Claspers rather stout, moderately long, and pointed. Colour pattern of back and sides of scattered large rusty spots and saddles on light brown background, light below.

Geographical Distribution : Western South Pacific: Australia (southern New South Wales, Victoria, Tasmania, South and southern Western Australia).

Habitat and Biology : A widespread, common but little-known bottom-dwelling catshark, on the temperate Australian continental shelf from close inshore to offshore, depth range 26 (or less) to 175 m; described as preferring firm bottom. Oviparous.



Size : Maximum about 61 cm, adult males 55 cm, adult females 57 cm; taxonomic status of small (adult males 37 cm) analis-like sharks uncertain, but possibly specifically or subspecifically distinct.

Interest to Fisheries : None at present, commonly taken by bottom trawlers.

Literature : Whitley (1940); Fowler (1941); Stead (1963); McKay (1966); Springer (1979).

Remarks : The holotype was examined by the writer in 1982 and is illustrated above.

Asymbolus vincenti (Zeitz, 1908)

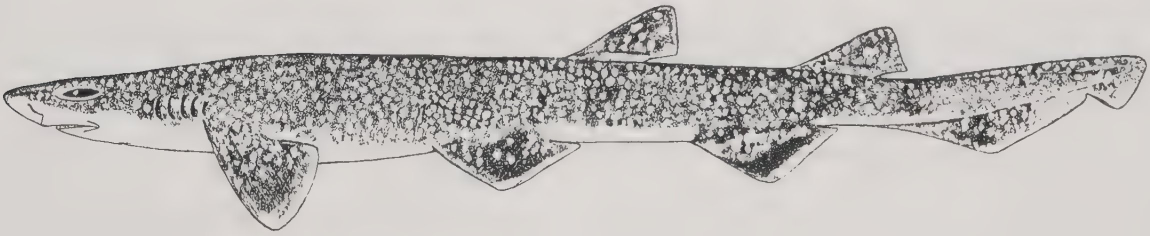
SCYL Asym 2

Scyllium vincenti Zeitz, 1908, Trans.Roy.Soc.S.Australia, 32:287. Syntypes: South Australian Museum. Type Locality: Investigator Strait and Kangaroo Island, South Australia.

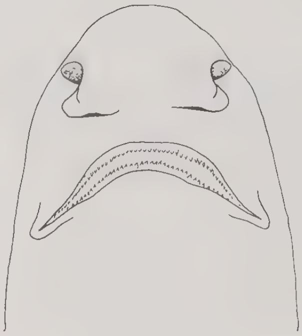
Synonymy : None.

Other Scientific Names Recently in Use : Halaelurus vincenti (Zeitz, 1908), Juncrus vincenti (Zeitz, 1908).

FAO Names : En - Gulf catshark; Fr - Chien tasmanien; Sp - Pejegato de Tasmania.



Field Marks : Simple colour pattern of small, densely scattered white spots on chocolate-brown, mottled back, sides and fins, light and unspotted below, head rather narrow and not greatly flattened, snout narrowly parabolic, short to moderately long, and rounded but not pointed or upturned, nostrils well separated from each other and from mouth, without nasoral grooves, eyes close to horizontal head rim, gill slits lateral, labial furrows short but present on both jaws, claspers of males with apron formed from fused pelvic inner margins, dorsal fins equally large, with origin of first over or behind pelvic insertions, anal fin somewhat larger than second dorsal fin and with its base partly in front of second dorsal base, no supracaudal crests of denticles, cranium without supraorbital crests.



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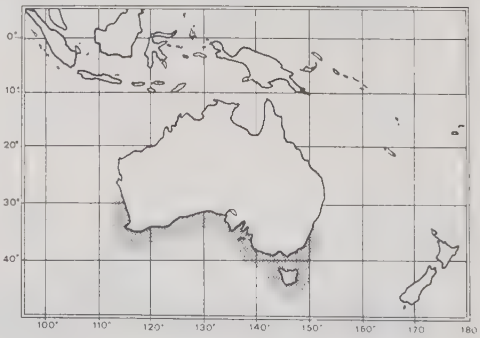
Diagnostic Features : Snout often more parabolic. Claspers very slender, elongated, and blunt-tipped. Colour pattern of back and sides of densely scattered small white spots on chocolate-brown mottled background, light below.



Geographical Distribution : Western South Pacific: Australia (Victoria, Tasmania, South and southern Western Australia).

Habitat and Biology : A widespread, little-known bottom-dwelling catshark, on the temperate Australian continental shelf and slope edge, at or near bottom at depths of 27 to 220 m. Oviparous; lays a single egg-case to each oviduct at a time. Size of egg-cases 5 cm long by 2 cm wide, with long filaments.

Size : Maximum about 61 cm, adult males 51 cm, adult females 45 to 53 cm.

Interest to Fisheries : None at present, taken by bottom trawlers.

Literature : Whitley (1940); Fowler (1941); Stead (1963); McKay (1966); Springer (1979).

Atelomycterus Garman, 1913

SCYL Atel

Genus : Atelomycterus Garman, 1913, Mem.Mus.Comp.Zool.Harv.Coll., 36:100.

Type Species : Scyllium marmoratum Bennett, 1830, by monotypy.

Synonymy : "Pseudogenus" (= subgenus), Deltascyllium Leigh-Sharpe, 1926 (Genus Scyllium Cuvier, 1817); Genus Atelomycterius Fowler, 1928 (error).

Field Marks : Variegated slender scyliorhinids with narrow head, enlarged anterior nasal flaps and nasoral grooves, long mouth and very long labial furrows, equal-sized dorsal fins, and small anal fin, smaller than the dorsal fins.

Diagnostic Features : Body not tadpole-shaped, moderately slender to slim and elongated, and cylindrical, tapering slightly to caudal fin; body firm and thick-skinned, with well-calcified dermal denticles; stomach not inflatable; tail moderately long, length from vent to lower caudal origin about 4/5 of snout-vent length. Head slightly depressed, narrowly rounded and not wedge-shaped in lateral view; head short, less than 1/5 of total length in adults; snout short, less than 3/4 of mouth width, thick, and slightly flattened, bluntly pointed in lateral view; snout not expanded laterally, rounded-parabolic or slightly angular in dorsoventral view, not bell-shaped; ampullal pores not greatly enlarged on snout; nostrils enlarged, but with incurrent and excurrent apertures only slightly open to exterior; anterior nasal flaps formed as enlarged, very broad, triangular lobes with angular or rounded posterior borders, without barbels, nearly meeting each other at midline of snout and extending posteriorly to overlap mouth; internarial space less than 0.5 times the nostril width; broad nasoral grooves present between excurrent openings and mouth, covered by anterior nasal flaps; eyes dorsolateral on head, narrow subocular ridges present below eyes; mouth angular or semiangular, moderately long, with lower symphysis close behind upper so that upper teeth are only slightly exposed in ventral view; labial furrows present along both upper and lower jaws, these very long and extending in front of level of upper symphysis of mouth; branchial region not greatly enlarged, distance from spiracles to fifth gill slits slightly more than half head length; gill slits lateral on head. Two dorsal fins present, about equal-sized or with the second slightly larger than the first; origin of first dorsal varying from over midbases of pelvics to about over their insertions; origin of second dorsal over the first quarter of the anal base; pectoral fins moderately large, their width slightly less to somewhat greater than mouth width; inner margins of pelvic fins not fused over claspers in adult males; claspers moderately to extremely long, fairly thick to very slender, and distally pointed or rounded, extending over half of their lengths behind the pelvic fin tips; anal fin small and not greatly elongated, smaller than pelvic and dorsal fins, its base length 0.8 to 1 times second dorsal base; origin of anal far behind pelvic bases, and insertion separated from lower caudal origin by a broad space two-thirds to about as long as the anal base; caudal fin short and broad, less than a fifth of total length in adults. No crests of denticles on the caudal margins. Supraorbital crests present on cranium. Colour light, with a varied colour pattern of dark and white spots, and dusky saddles on the sides and dorsal surface, with dark spots enlarged and partially coalescing in some species.

Remarks : McKay (1966), described what he termed Atelomycterus marmoratus from Western Australia, but examination of his material by the writer revealed that this record is based on two species, a hatchling A. macleayi and two specimens of a new species of Atelomycterus that differs from A. macleayi and A. marmoratus in its stouter body, different colour pattern, dorsal fin shape, smaller anal fin, and longer snout. It additionally differs from A. marmoratus in its short, stout claspers with a different arrangement of clasper glans structures. Additional specimens of this species have been collected off of northwestern Australia, and it will be described by Dr John Stevens and the writer.

Key to Species :

1a. Colour pattern of grey saddles separated by light areas and outlined by numerous small black spots (hatchlings have a simpler pattern of dusky saddles, remarkably similar to to the coolie loach, Acanthophthalmus semicinctus) .... **A. macleayi**

1b. Saddle markings obsolete, light grey and white spots outlined by large black spots, bars and lines .... **A. marmoratus**

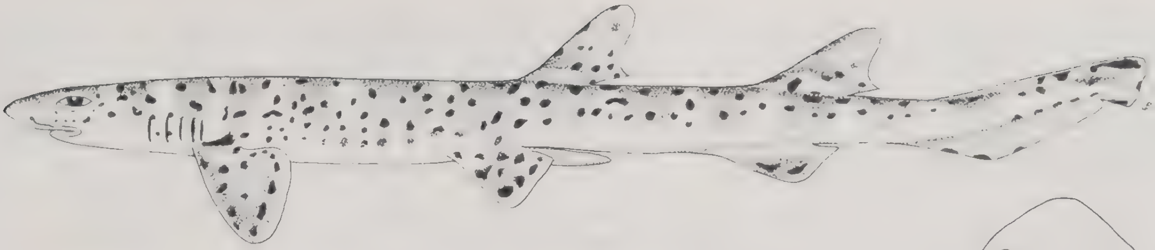
Atelomycterus macleayi Whitley, 1939

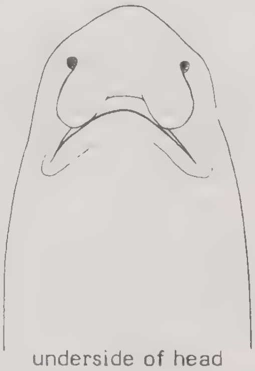
SCYL Atel 2

Atelomycterus macleayi Whitley, 1939, Aust.Zool., 9(3):230, fig. 3. Holotype: Australian Museum, Sydney, AMS I.5269, 488 mm adult male. Type Locality: Port Darwin, Northern Australia, Timor Sea, Indian Ocean.

Synonymy : None.

FAO Names : En - Australian marbled catshark; Fr - Chien marbré; Sp - Pejegato jaspeado.





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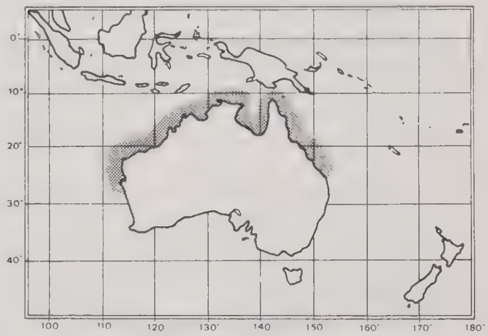
Field Marks : Very slender, narrow-headed catshark with variegated colour pattern, grey saddles spaced by light ground colour and outlined with small black spots, anterior nasal flaps greatly expanded and extending to mouth, nasoral grooves present, first dorsal with origin about opposite pelvic insertions, second dorsal fin much larger than anal fin and subequal to first dorsal.

Diagnostic Features : Claspers of adult males stout and moderately long, reaching about halfway to anal origin. Colour pattern highly variegated, grey dorsal saddles well-marked and separated by light ground colour, black spots small, numerous, and outlining saddle areas as well as being scattered on flanks, no small or large white spots scattered on sides and back.



Geographical Distribution : Western South Pacific: Australia (Northern and Western Australia, Queensland).

Habitat and Biology : A little-known inshore, shallow-water catshark, found on sandy and rocky bottom at depths of 0.5 to 3.5 m and presumably deeper. Oviparous.

Size : Maximum about 60 cm; adult males at 48 to 49 cm; adult females 51 cm. Size at hatching probably about 10 cm.

Interest to Fisheries : None at present.

Literature : Whitley (1939, 1940); McKay (1966); Springer (1979).

Remarks : Springer (1979) was uncertain if this species was valid or a synonym of A. marmoratus, but examination of its holotype and other material convinced me that the species is readily separable from nominal A. marmoratus by its colour pattern, shorter, stouter claspers, and differences in the external structures of its clasper glans. Whitley (1939, 1940) suggested that the species differed in egg-case morphology from A. marmoratus. Records of A. marmoratus from Western Australia (McKay, 1966) include a hatchling of this species as well as two specimens of an undescribed Australian Atelomycterus.

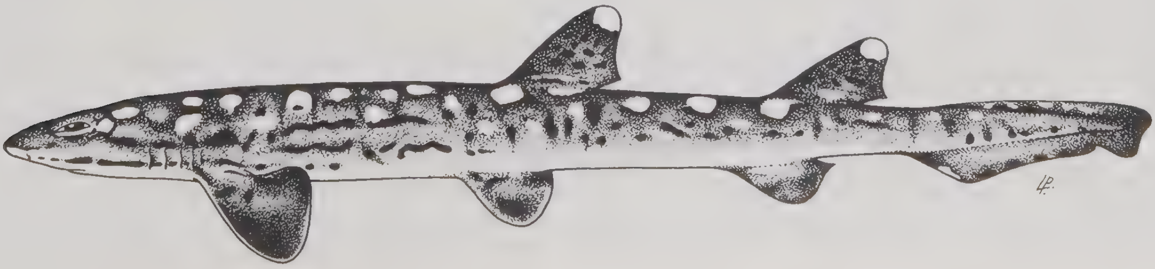
Atelomycterus marmoratus (Bennett, 1830)

SCYL Atel 1

Scyllium marmoratum Bennett, 1830, Mem.Life Pub.Serv.Sir Stamford Raffles, London, 693. Holotype: Possibly lost according to Springer (1979). Type Locality: Sumatra.

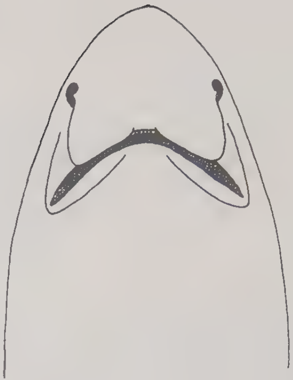
Synonymy : Scyllium maculatum Gray, 1832; Scyllium pardus Temminck, in Müller & Henle, 1838 (name only).

FAO Names : En - Coral catshark; Fr - Chien corail; Sp - Pintarroja coralera.



Field Marks : Very slender, narrow-headed catshark with variegated colour pattern, grey saddle markings obsolete, black spots enlarged and merging together to form dash and bar marks that bridge saddle areas, large white spots scattered on sides and back, anterior nasal flaps greatly expanded and extending to mouth, nasoral grooves present, first dorsal with origin about opposite or slightly in front of pelvic insertions, second dorsal fin much larger than anal fin and subequal to first dorsal.

Diagnostic Features : Claspers of adult males extremely attenuated and narrow, reaching at least 2/3 of distance from pelvic insertions to anal origin. Colour pattern highly variegated, dorsal saddles obsolete, black spots enlarged and often merging together to form dash and bar marks that bridge saddle areas, light ground colour forming large white spots scattered on sides and back.



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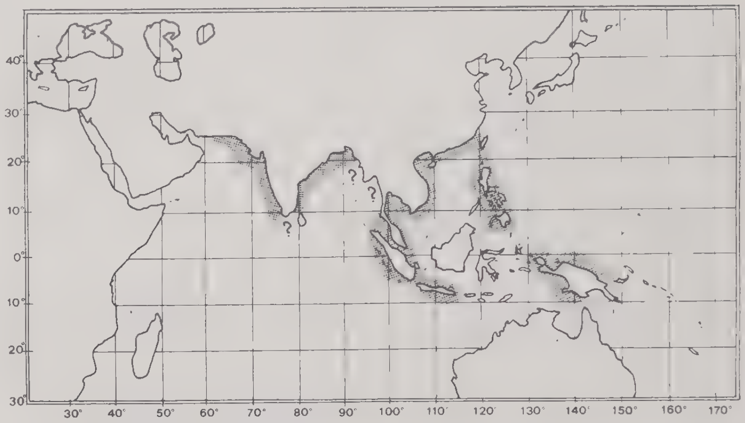


Geographical Distribution : Indo-West Pacific: Pakistan and India to Malaya; Singapore, Indonesia, New Guinea, Thailand, Viet Nam, The Philippines, southern China, including Taiwan Island.

Habitat and Biology : A common but little-known, harmless inshore species, found on coral reefs, and thought to inhabit crevices and holes on reefs. Oviparous, with single egg-cases laid per oviduct.

Size : Maximum 70 cm; adult males 47 to 62 cm; adult females 49 to 57 cm.

Interest to Fisheries : Unimportant, captured close inshore. Relatively common and forming a minor catch of inshore artisanal fisheries. Probably caught with line gear and gillnets, with flesh utilized fresh and dried-salted for food or processed for fishmeal and oil.

Literature : Garman (1913); White (1937); Fowler (1941); Springer (1979).

Remarks : Springer (1979) warned that all records of this wide-ranging, attractive little shark might not pertain to a single species. The Philippines and Singapore specimens of the species examined by the writer are probably conspecific, but Western Australian specimens of this species (recorded by McKay, 1966) include A. macleayi and an undescribed species. Unfortunately, the writer did not find any specimens of Atelomycterus either in the field or in collections when he visited India in 1982.

Aulohalaelurus Fowler, 1934

SCYL Aul

Genus : Subgenus Aulohalaelurus Fowler, 1934 (Genus Halaelurus Gill, 1862), Proc.Acad.Nat.Sci.Philad., 85:237.

Type Species : Catulus labiosus Waite, 1905, by original designation.

Synonymy : None.

Diagnostic Features : Body not tadpole-shaped, moderately slender and cylindrical, tapering slightly to caudal fin; body firm and thick-skinned, with well-calcified dermal denticles; stomach not inflatable; tail moderately short, length from vent to lower caudal origin about 3/5 of snout-vent length. Head slightly depressed, narrowly rounded and not wedge-shaped in lateral view; head short, less than 1/5 of total length in adults; snout short, less than 3/4 of mouth width, thick, and slightly flattened, bluntly pointed in lateral view; snout not expanded laterally, rounded-parabolic and slightly bell-shaped in dorsoventral view; ampullal pores not greatly enlarged on snout; nostrils enlarged, but with incurrent and excurrent apertures only slightly open to exterior; anterior nasal flaps formed as broad triangular lobes with truncated posterior borders, without barbels, well separated from each other and ending slightly anterior to mouth; internarial space about 1.4 times the nostril width; nasoral grooves absent; eyes dorsolateral on head, narrow subocular ridges present below eyes; mouth angular or semiangular, moderately long, with lower symphysis somewhat behind upper so that upper teeth are well-exposed in ventral view; labial furrows present along both upper and lower jaws, these very long and extending in front of level of upper symphysis of mouth; branchial region not greatly enlarged, distance from spiracles to fifth gill slits about half of head length; gill slits lateral on head. Two dorsal fins present, about equal-sized or with the second slightly larger than the first; origin of first dorsal about over pelvic insertions; origin of second dorsal over the first quarter of the anal base; pectoral fins moderately large, their width slightly greater than mouth width; inner margins of pelvic fins not fused over claspers in adult males; claspers moderately long, fairly thick, and distally pointed or rounded, extending about half of their lengths behind the pelvic fin tips; anal fin small and not greatly elongated, smaller than pelvic and dorsal fins, its base length about equal to second dorsal base; origin of anal far behind pelvic bases, and its insertion separated from lower caudal origin by a space about half as long as the anal base; caudal fin short and broad, less than a fifth of total length in adults. No crests of denticles on the caudal margins. Supraorbital crests present on cranium. Colour dark grey with a variegated colour pattern of dark and white spots, and dark saddles on the sides and dorsal surface.

Remarks : Springer (1979) raised the rank of Aulohalaelurus to genus for the Australian A. labiosus. While definitely not congeneric with Halaelurus, Aulohalaelurus is very close to the genera Atelomycterus and Schroederichthys and needs to be critically compared with these taxa to determine its validity.

Aulohalaelurus labiosus (Waite, 1905)

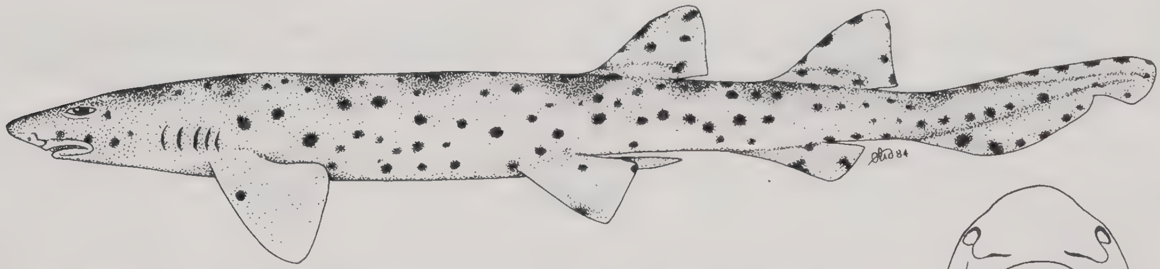
SCYL Aul 1

Catulus labiosus Waite, 1905, Rec.Aust.Mus., 6(2):57, fig. 23. Holotype: Western Australian Museum, WAM PO 13253-001, 620 mm adult male. Type Locality: Freemantle, Australia.

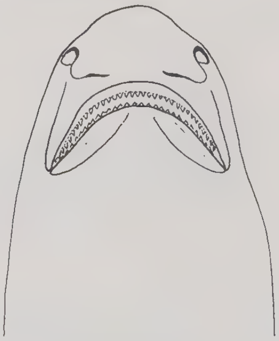
Synonymy : ? Squalus maculatus Bloch & Schneider, 1801 (doubtful synonym according to Fowler, 1941, but possibly based on Squalus maculatus Bonnaterre, 1788 = Orectolobus maculatus).

Other Scientific Names Recently in Use : Halaelurus labiosus (Waite, 1905).

FAO Names : En - Blackspotted catshark; Fr - Chien à taches noires; Sp - Pejegato estrellado.



Field Marks : A moderately slender, cylindrical-bodied, relatively narrow-headed catshark with a variegated colour pattern of small to large black spots and obscure dusky saddles on light brown background of sides, back and fins, very long upper labial furrows that reach in front of upper symphysis, a short, bluntly rounded snout, moderately large anterior nasal flaps that do not meet each other at the midline of the snout, no nasoral grooves, equal-sized dorsal fins, origin of first dorsal over or slightly in front of pectoral insertions, and anal fin much smaller than second dorsal and about opposite its base.



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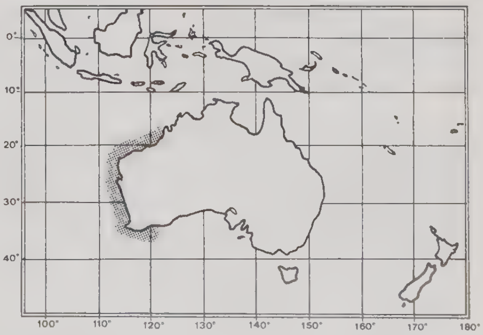
Diagnostic Features : See genus.

Geographical Distribution : Confined to Western Australia, Eastern Indian Ocean. Whitley (1940) and McKay (1966) noted that records of this species from Northern Australia and Queensland are erroneous.



Habitat and Biology : A common inshore catshark of the Western Australian continental shelf, but little-known. Depth to at least 4 m.

Size : Maximum 67 cm; adult males 54 to 62 cm, adult females 67 cm.

Interest to Fisheries : None at present.

Literature : Whitley (1940); Fowler (1941); Stead (1963); McKay (1966); Springer (1979).

Remarks : Specimens of this small attractively coloured shark were examined by the writer in the Western Australian Museum.

Cephaloscyllium Gill, 1862

SCYL Cep

Genus : Cephaloscyllium Gill, 1862, Ann.Lyceum Nat.Hist.N.Y., 7:408, 412.

Type Species : Scyllium laticeps Dumeril, 1853 by original designation.

Synonymy : None.

Field Marks : Stocky, short-tailed scyliorhinid with no labial furrows, an inflatable stomach, and the second dorsal fin much smaller than the first.

Diagnostic Features : Body not tadpole-shaped, very stout and spindle-shaped, tapering considerably to caudal fin; body firm and thick-skinned, with well-calcified dermal denticles; stomach inflatable with air or water; tail short, length from vent to lower caudal origin between 2/5 to slightly less than 1/2 of snout-vent length. Head very depressed and broad, narrowly rounded and not wedge-shaped in lateral view; head fairly short, between 1/4 to 1/5 to less than 1/5 of total length in adults; snout very short, less than 1/2 of mouth width, thick, and somewhat flattened, bluntly pointed in lateral view; snout not expanded laterally, rounded-parabolic or subangular in dorsoventral view; ampullal pores not greatly enlarged on snout; nostrils not enlarged, with incurrent and excurrent apertures only slightly open to exterior; anterior nasal flaps broadly tringular to elongated and lobate, without barbels, falling slightly anterior to mouth or reaching it; internarial space 1 to 1.7 times the nostril width; nasoral grooves absent; eyes dorsolateral on head, broad subocular ridges present below eyes; mouth broadly arched or angular, very large and long, with lower symphysis usually somewhat behind upper so that upper teeth are well-exposed in ventral view (lower jaw covering upper teeth in C. silasi); labial furrows absent or vestigial; branchial region not greatly enlarged, distance from spiracles to fifth gill slits 1/2 to 2/5 of head length; gills lateral on head. Two dorsal fins present, with the second considerably smaller than the first; origin of first dorsal about over anterior halves of pelvic bases; origin of second dorsal over or slightly posterior to the anal origin; pectoral fins large, but with their widths varying from less to considerably greater than mouth width; inner margins of pelvic fins not fused over claspers in adult males; claspers moderately long and thick to slender and very long, distally rounded, extending 1/2 to 4/5 of their length behind the pelvic fin tips; anal fin moderately large, but not greatly elongated, subequal to pelvic and first dorsal fins, but much larger than second dorsal, its base length 1.2 to 1.4 times the second dorsal base; origin of anal well behind pelvic bases, and its insertion separated from lower caudal origin by a space 3/4 to 3/5 of anal base; caudal fin short and broad, between a fourth and a fifth of total length in adults. No crests of denticles on the caudal margins; supraorbital crests present on cranium. Colour varying from uniform grey or brown to variegated with obscure darker saddles and blotches, reticulated dark lines, or numerous dark spots in addition to the saddles and blotches.

Remarks : The present arrangement of Cephaloscyllium is tentative and follows the revision of Springer (1979) with modifications. Scyliorhinus (Halaelurus) silasi Talwar, 1974 was placed by Springer (1979) in Halaelurus, as an apparent synonym of H. quagga, but it is quite evidently a dwarf species of Cephaloscyllium.

Springer (1979) separated Cephaloscyllium isabellum, from New Zealand, from the Australian Cephaloscyllium laticeps by egg-case morphology only (ridged or 'laminated' in the Australian species and smooth in the New Zealand form), but this was done under the assumption that there was only a single species of Cephaloscyllium in Australian waters. New material from Australia under study by the writer and Dr. John Stevens suggests that, apart from the dwarf Cephaloscyllium fasciatum which was lately collected off northwestern Australia, the Australian swellsharks may comprise at least two large-sized species, a highly variegated and spotted species probably referable to C. laticeps, and the broad-blotched unspotted C. nascione with conspicuous light fin margins. There are also some small Australian swellsharks of uncertain species, that feature scattered black spots on a uniform background. The question arises as to whether C. laticeps really differs from C. isabellum by having 'laminated' egg-cases, or if these come from C. nascione or some other species. Whitley (1940) thought that C. laticeps laid smooth eggs, but noted that "Mr H.M. Hale records 'laminated' eggs as having been laid by South Australian specimens in March, 1929". Unfortunately the swellsharks from which the 'laminated' eggs were taken were not described. With uncertainty as to the type of egg laid by C. laticeps, and no morphological differences between this species and C. isabellum, except possibly colour pattern, the separation of these species becomes questionable. They are listed separately in the species accounts below, at least until Australian and New Zealand swellsharks of the isabellum type can be critically compared.

Springer (1979) also synonymized the Japanese C. umbratile and the Taiwanese C. formosanum with C. isabellum. While this may or may not be correct, there is an additional complication in the form of a dwarf swellshark that occurs in the western North Pacific, that has been generally confused with the large C. umbratile (= C. isabellum) but which differs in its simple blotched colour pattern, differently formed anterior nasal flaps, and longer snout. This probably represents an undescribed species, which is not placed in the key below.

Key to Species :

1a. Colour pattern of bold dark lines forming saddles and open-centred blotches on back and sides .... C. fasciatum

1b. Colour pattern variable but not in the form of dark lines

2a. A strongly variegated colour pattern of close-set dark saddles and blotches, numerous dark spots and occasional light spots on a lighter background

3a. Anterior nasal flaps extending to mouth. Underside heavily spotted .... **C. ventriosum**

3b. Anterior nasal flaps not reaching mouth. Underside not spotted .... **C. isabellum**
C. laticeps

2b. Colour pattern not strongly variegated, usually simple broad dusky saddles on a light background, no dark or light spots

4a. Anterior nasal flaps broadly triangular, overlapping mouth. Caudal peduncle slender. Claspers narrow and greatly elongated. A dwarf species, adults less than 40 cm .... **C. silasi**

4b. Anterior nasal flaps narrow based and lobate, not overlapping mouth. Caudal peduncle stout. Claspers broad and not greatly elongated. Large species, adults to one metre or more

5a. Colour pattern of obscure dusky saddles on back, sometimes obsolete in adults, fins not conspicuously light-edged .... **C. sufflans**

5b. Colour pattern of prominent dusky saddles on back and broad dark lines on head, fins dusky with conspicuous light edges .... **C. nascione**

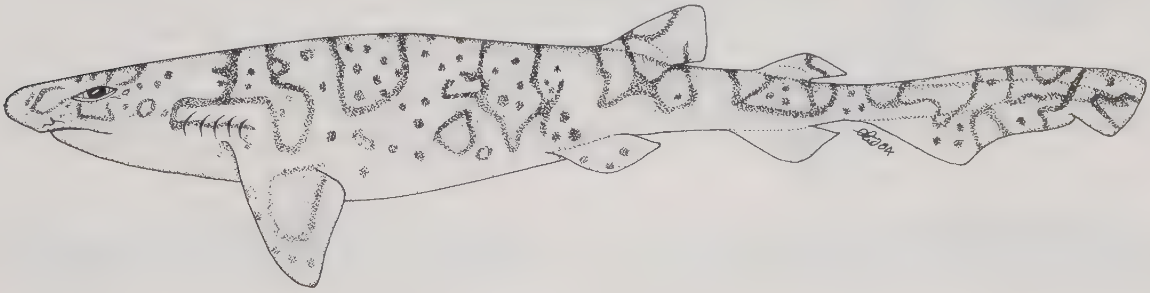
Cephaloscyllium fasciatum Chan, 1966

SCYL Cep 1

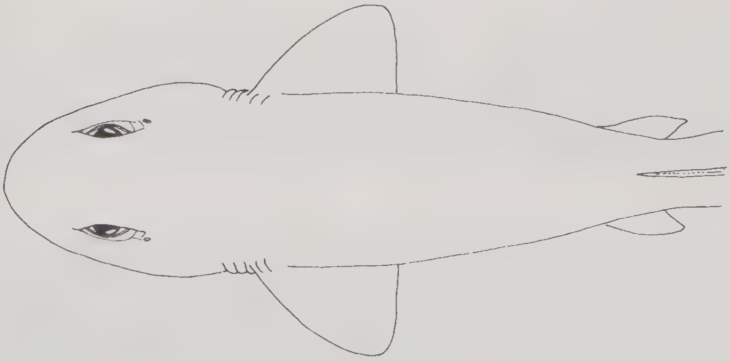
Cephaloscyllium fasciatum Chan, 1966, J.Zool., Lond., 148:252, fig. 6. Holotype: British Museum (Natural History), BMNH 1965.8.11.1, 422 mm adolescent or adult female. Type Locality: 15°55.7'N, 109°18.5'E, from 205 to 315 m depth.

Synonymy : None.

FAO Names : En - Reticulated swellshark; Fr - Holbiche bouffie; Sp - Pejegato mallero.

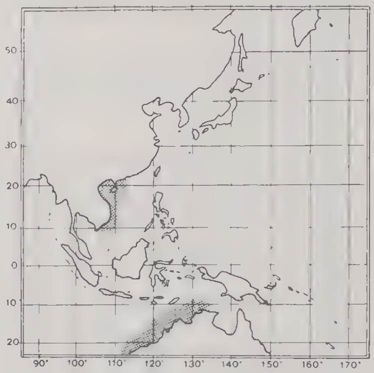


Field Marks : A catshark with a stout body, no labial furrows, and with a striking colour pattern of narrow dark lines arranged as open-centred saddles, loops, reticulations and spots, as well as moderately large dark spots (absent in young) on light ground colour, anterior nasal flaps elongate, lobate, and not overlapping mouth posteriorly, and second dorsal fin much smaller than first.



partial dorsal view

Diagnostic Features: Snout rounded-angular in dorsoventral view, very short; anterior nasal flaps narrowly lobate, not overlapping mouth posteriorly. Colour pattern of dark brown lines formed into open-centred saddles, spots, and reticulations on a light greyish brown background, also some small dark brown spots on sides and back; underside of head and abdomen spotted; fins without conspicuous light margins. A small species, adult at less than 50 cm.



Geographical Distribution: Western Pacific: Viet Nam, China (Hainan Island), northwestern Australia.

Habitat and Biology: A tropical swellshark found in deepish water on or near the bottom on the outer continental shelf and uppermost slope, at depths of 219 to 314 m; caught on mud bottom. Can expand itself with air or water.

Size: Maximum at least 42 cm (adolescent or adult female).

Interest to Fisheries: None at present, caught by commercial bottom trawlers.

Literature: Chan (1966); Springer (1979).

Remarks: Recently taken off northwestern Australia (Dr J.D. Stevens, pers.comm.).

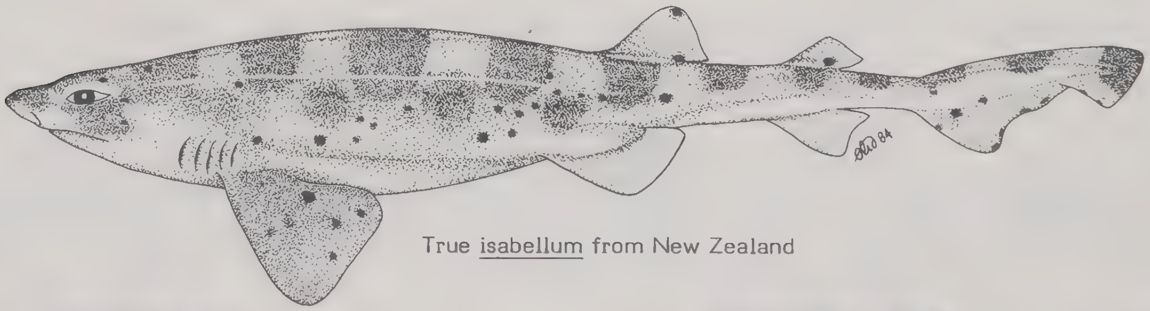
Cephaloscyllium isabellum (Bonnaterre, 1788)

SCYL Cep 2

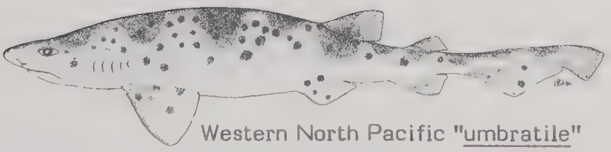
Squalus isabella Bonnaterre, 1788, Ichthyologia, 6. Holotype: Apparently lost, according to Springer (1979). Type Locality: "La mer du sud".

Synonymy: Scyllium sabella Gmelin, 1789; Scyllium lima Richardson, 1842; ? Cephaloscyllium umbratile Jordan & Fowler, 1903; ? Cephaloscyllium formosanum Teng, 1962.

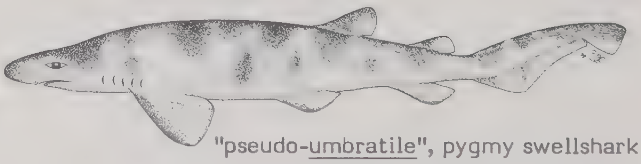
FAO Names: En - Draughtsboard shark; Fr - Holbiche damier; Sp - Pejegato ajedrezado.



True isabellum from New Zealand



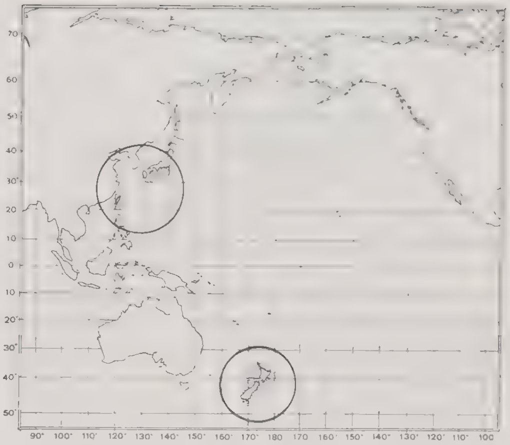
Western North Pacific "umbratile" type from Japan, China



"pseudo-umbratile", pygmy swellshark from China

Field Marks: A catshark with a stout body, no labial furrows, and with a striking colour pattern of dark dorsal saddles, lateral blotches, and small to moderately large dark spots on light ground colour, anterior nasal flaps short, subtriangular, and not overlapping mouth posteriorly, and second dorsal fin much smaller than first.

Diagnostic Features: Snout broadly rounded-angular in dorsoventral view, rather short and broad; anterior nasal flaps subtriangular, not overlapping mouth posteriorly. Claspers short and stout. Colour pattern variegated, with up to 11 dark brown irregular saddles and laterally interdigitating blotches in a checkerboard pattern in the typical New Zealand form, but with more irregular dark blotches and mottling in Taiwanese and Japanese representatives of the species (if not distinct); a scattering of numerous dark brown or blackish small spots on a grey or brown background; underside of head and abdomen unspotted; fins without conspicuous light margins. A large species (see size below).



Geographical Distribution : Western Pacific: New Zealand, China (Taiwan Island) and Japan (southeastern Honshu).

Habitat and Biology : A common, sluggish inshore and offshore warm-temperate catshark found on rocky and sandy bottoms in deepish water on the continental and insular shelves, at depths of 18 to 220 m; said to avoid open areas but favours reefs. Can expand itself with air or water. Oviparous. Eats crabs, worms and other invertebrates, and probably bony fishes.

Size : Maximum 92 to 100+cm, said to reach 244 cm off New Zealand but possibly due to confusion with some other shark, such as Notorynchus cepedianus; adult males 69+cm; adult females 86 cm.

Interest to Fisheries : None or limited at present, caught by commercial bottom trawlers.

Literature : Jordan & Fowler (1904); Whitley (1940); Fowler (1941); Teng (1962); Garrick & Paul (1974); Springer (1979).

Remarks : As noted in the generic remarks, above, the synonymy of this species is tentative, and follows Springer (1979). The holotype of Cephaloscyllium umbratile in the Stanford University collections (a 95 cm adult male specimen, SU 12693, preserved as a skin according to Jordan & Fowler, 1904), could not be located by Springer (1979) or the writer, and is presumed lost. Several writers, including Teng (1962), Chen (1963), Fourmanoir & Nhu-Nhung (1965), Chan (1966), Bessednov (1969), and Nakaya (1975) have reported a species of Cephaloscyllium from Viet Nam, China, (including Taiwan Island) and Japan as C. umbratile. This apparently differs from C. isabellum (or C. umbratile-formosanum, if distinct) in its smaller size at maturity (adult males 39 to 42 cm, females at 36 to 42 cm, versus isabellum at over 60 cm), colour pattern of indistinct dusky saddles and blotches without small spots and mottling, longer snout, and more elongated nasal flaps. Comparison of Jordan & Fowler's (1904) original description of C. umbratile with Teng's (1962) accounts of C. umbratile and C. formosanum suggests that the latter writer renamed the true large umbratile as C. formosanum in the belief that the small species was umbratile. The writer has examined specimens of the small "umbratile" from off Hong Kong and suspects that these represent an undescribed species of dwarf swellshark, not conspecific with the other small species C. silasi and C. fasciatum.

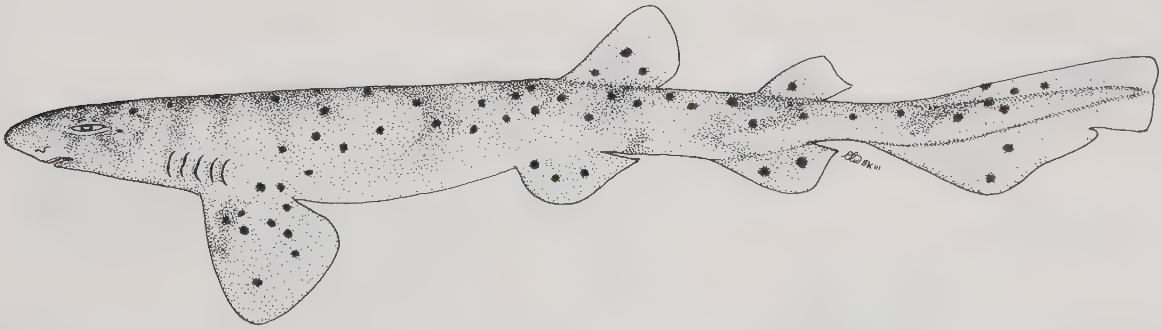
Cephaloscyllium laticeps (Dumeril, 1853)

SCYL Cep 3

Scyllium laticeps Dumeril, 1853, Rev.Mag.Zool., ser. 2, 5:84. Holotype: Museum National d'Histoire Naturelle, Paris, MNHN A.9378, stuffed male 790 mm long. Type Locality: New Holland (Tasmania).

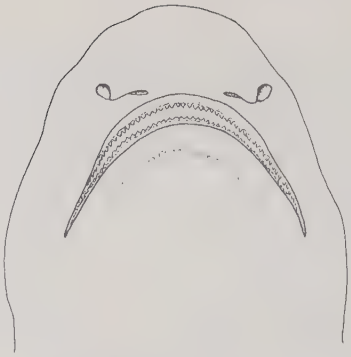
Synonymy : None.

FAO Names : En - Australian swellshark; Fr - Holbiche gressouillette; Sp - Pejegato australiano.

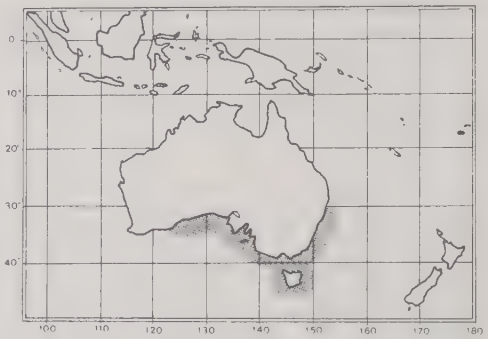


Field Marks : A catshark with a stout body, no labial furrows, and with a striking colour pattern of mottled dark dorsal and lateral blotches and small to moderately large dark spots on light ground colour, light undersides with slight mottling on at least fins, anterior nasal flaps short, subtriangular, and not overlapping mouth posteriorly, and second dorsal fin much smaller than first.

Diagnostic Features : Snout broadly rounded in dorsoventral view, rather short and broad; anterior nasal flaps subtriangular, not overlapping mouth posteriorly. Claspers short and stout. Colour pattern of variegated dark brown or greyish blotches and saddles and numerous dark and some light spots on a lighter grey or chestnut background on body and fins, underside of head and abdomen cream, not strongly spotted; fins without conspicuous light margins.


underside of head

Geographical Distribution : Western Pacific: Australia (South Australia, Tasmania, Victoria, New South Wales).



Habitat and Biology : A temperate-water swellshark found in shallow to deepish water on or near the bottom on the continental shelf from close inshore down to 220 m. Can expand itself with air or water. Oviparous.

Size : Maximum at least 97 cm (adults).

Interest to Fisheries : None at present, caught by commercial bottom trawlers.

Literature : Whitley (1940); Fowler (1941); Stead (1963); Springer (1979).

Remarks : See generic remarks, above, for a discussion of the separation of this species from C. isabellum, which is uncertain at present.

Cephaloscyllium nascione Whitley, 1932

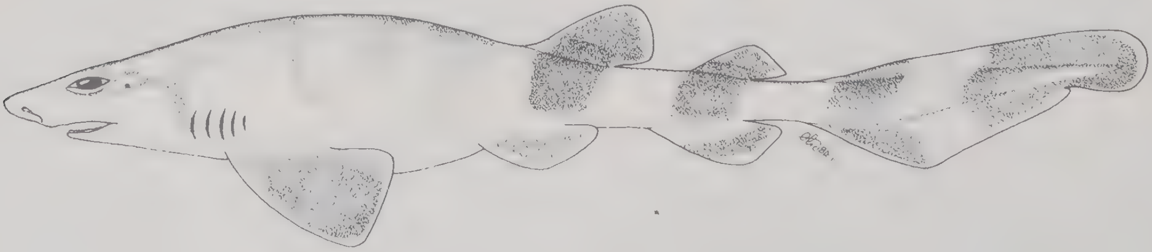
SCYL Cep 4

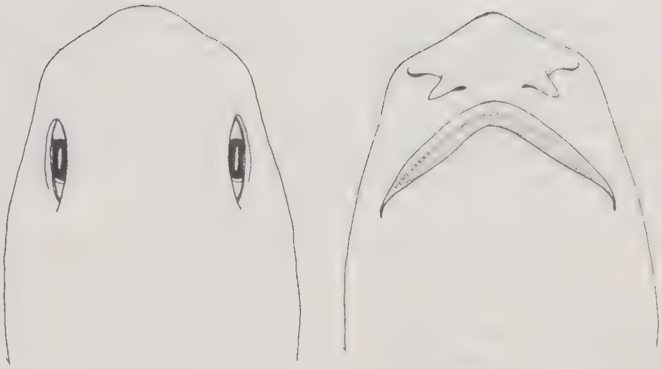
Cephaloscyllium i. (isabella) laticeps, forma nascione Whitley, 1932, Rec.Aust.Mus., 18(6):324, fig. 2, no. 2. Holotype: Australian Museum, Sydney, AMS IA 2829, 255 mm female, immature. Type Locality: Montague Island, New South Wales, Australia (165 m depth).

Synonymy : None.

Other Scientific Names Recently in Use : Cephaloscyllium laticeps forma nascione Whitley, 1932 (Whitley, 1940).

FAO Names : En - Whitefinned swellshark; Fr - Holbiche isabelle; Sp - Pejegato bordeado.

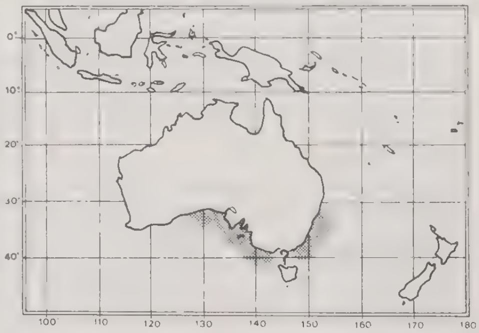



dorsal view of head

underside of head

Field Marks : A catshark with a stout body, no labial furrows, second dorsal fin much smaller than first, and with a simple colour pattern of dark saddles and light-margined fins, anterior nasal flaps elongate, lobate, and not overlapping mouth posteriorly.

Diagnostic Features : Snout broadly rounded-angular in dorsoventral view, moderately short; anterior nasal flaps elongate and lobate, not overlapping mouth posteriorly. Claspers short and stout. Colour pattern of eight or nine prominent grey-brown saddles on a light tan or grey-brown background, underside of head and abdomen unspotted; precaudal fins grey-brown with conspicuous light margins. A large species (see size below).



Geographical Distribution : Western Pacific: Australia (New South Wales, and South Australia).

Habitat and Biology : A little-known, bottom-dwelling shark of the outer continental shelf, occurring at depths of 146 to 220 m. Probably oviparous, although egg-cases of this species remain to be positively identified.

Size : Probably at least 1 m, adult males over 80 cm.

Interest to Fisheries : Very limited, taken by commercial trawlers with bottom trawls.

Literature : Whitley (1940).

Remarks : This species was considered a 'form' or subspecies of C. laticeps or C. isabella by Whitley (1932, 1940), and included in synonymy of C. isabella by Springer (1979), but examination of the holotype (illustrated) and other material suggests that this is a separate species. It is apparently not identical to the small western North Pacific swellshark termed C. umbratile by various writers, which has a superficially similar colour pattern.

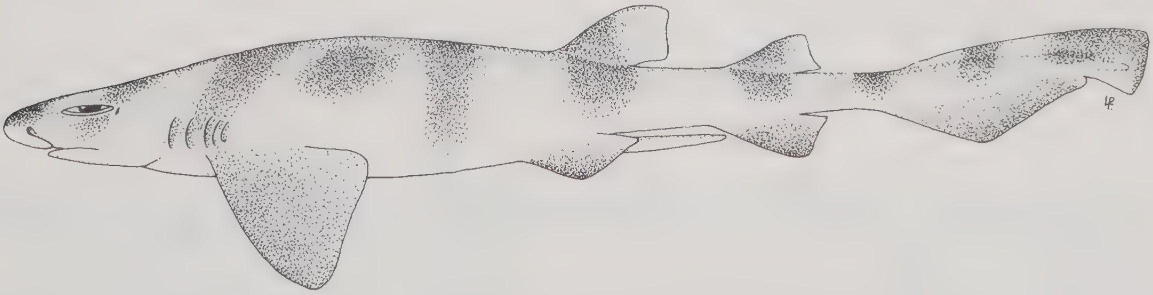
Cephaloscyllium silasi (Talwar, 1974)

SCYL Cep 5

Scyliorhinus (Halaelurus) silasi Talwar, 1974, J.Mar.Biol.Assoc.India, 14(1):779, fig. 1. Holotype: Zoological Survey of India, Calcutta, ZSI F.6562/2, 318 mm female. Type Locality: Indian Ocean, off Quilon, Kerala, India, 9°N, 76°E at 300 m depth.

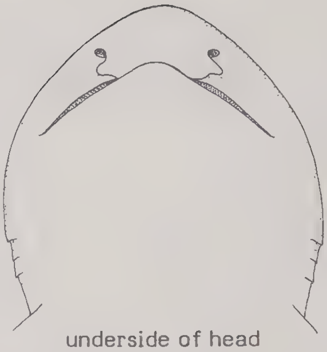
Synonymy : None.

FAO Names : En - Indian swellshark; Fr - Holbiche indienne; Sp - Pejegato de Silas.



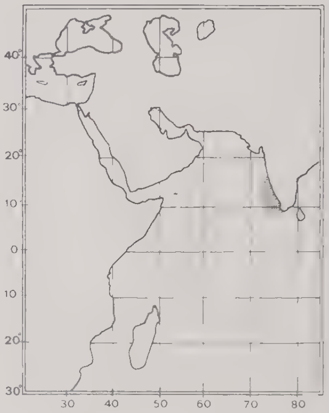
Field Marks : A small catshark with a stout body, no labial furrows, and with a simple colour pattern of dark saddles, head extremely broad, snout obtusely wedge-shaped, anterior nasal flaps elongate, lobate, and overlapping mouth posteriorly.

Diagnostic Features : Snout obtusely wedge-shaped in dorsoventral view, extremely broad and short; anterior nasal flaps broadly subtriangular and with a triangular rear margin, overlapping mouth posteriorly. Claspers very slender and elongated. Colour pattern of seven moderately broad dark brown saddles on a light brown background, plus an obscure darker blotch over the pectoral inner margins, underside of head and abdomen unspotted and light brown; fins without conspicuous light margins. A dwarf species (see size below).



underside of head

Geographical Distribution : Presently known only from the vicinity of Quilon, India, where it is relatively common (P.K. Talwar, pers.comm.).



Habitat and Biology : A little-known bottom-dwelling shark of the uppermost continental slope. The type series, including the holotype and three paratypes, were collected at 300 m depth with an otter trawl.

Size : Probably a dwarf species, as the largest known specimen, a male, is adult at 36 cm long.

Interest to Fisheries : None at present.

Literature : Talwar (1974); Springer (1979); Compagno & Talwar (1983, in press).

Remarks : Springer (1979) listed this species in Halaelurus as an apparent synonym of Halaelurus quagga, but stated that the species was of uncertain validity. Reexamination of the type series of S. (H.) silasi indicates that the species is valid and a distinct member of the genus Cephaloscyllium (Compagno & Talwar, 1983, in press). The illustration is based on an adult male paratype.

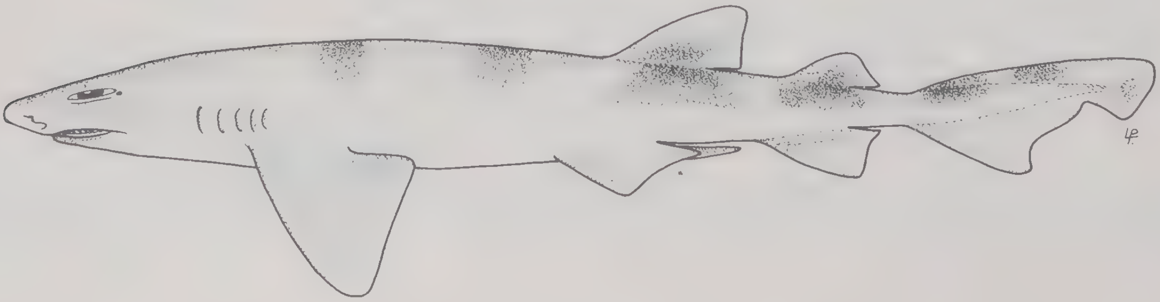
Cephaloscyllium sufflans (Regan, 1921)

SCYL Cep 6

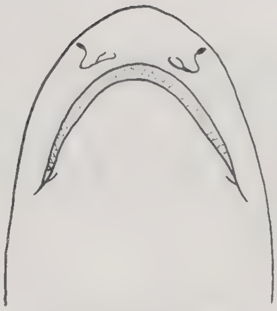
Scyliorhinus (Cephaloscyllium) sufflans Regan, 1921, Ann.Mag.Nat.Hist.(Ser. 9), 7(41):413. Holotype: British Museum (Natural History), 750 mm. Type Locality: About 24 to 35 km off Unvoti River, Natal, South Africa in 220 to 238 m depth.

Synonymy : None.

FAO Names : En - Balloon shark; Fr - Holbiche soufflue; Sp - Pejegato balón.



Field Marks : A moderately large, stout catshark with no labial furrows, second dorsal much smaller than first, a simple colour pattern of obscure dark saddles, often obsolete, snout broadly rounded, anterior nasal flaps elongate, lobate, and not overlapping mouth posteriorly.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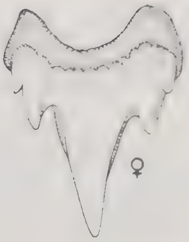
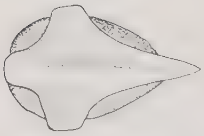
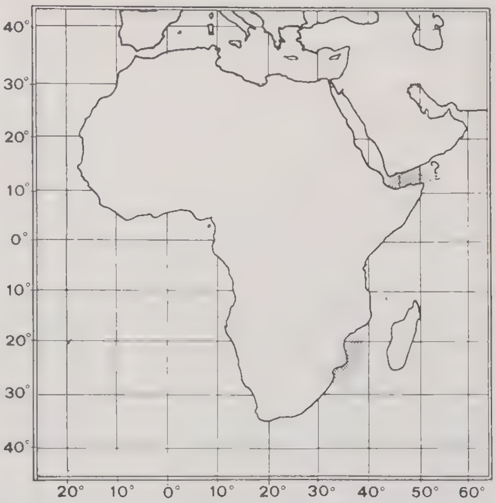


tooth


dermal denticle

Diagnostic Features : Snout broadly rounded-angular in dorsoventral view, broad and short; anterior nasal flaps fairly elongate and lobate, not overlapping mouth posteriorly. Claspers moderately short and stout. Colour pattern of 7 light grey-brown saddles on a lighter, pale-grey brown background, these saddles obscure or absent in adults, pectorals dusky above, underside unspotted; fins without conspicuous light margins. A large species (see size below).

Geographical Distribution : Western Indian Ocean: South Africa and Mozambique, doubtfully from Gulf of Aden.



Habitat and Biology : A common warm-temperate and subtropical offshore catshark on the continental shelf and uppermost slope at depths from 40 to 440 m, commonly on sand and mud bottom (unlike C. ventriosum, which prefers rocky bottom and is appropriately spotted and mottled). As with other members of the genus, this catshark can inflate itself when disturbed.

Oviparous, apparently laying one egg-case per oviduct. Immature individuals of this shark are common in trawl hauls off Natal at 40 to 440 m depth, but adults are not, and egg-cases have yet to be found. This suggests that adults mostly live in deeper water than these juveniles and lay eggs there, or are geographically displaced, perhaps off northern Mozambique.

These sharks eat a variety of bottom prey including mostly crustaceans (lobsters and shrimp) and cephalopods, but also bony fishes and other elasmobranchs, taken on muddy or sandy bottom.

Size : Maximum 106 cm; males adolescent at 70 to 75 cm, adult males to 89 cm; females immature at 71 cm or less, adult females 82 to 109 cm; size at hatching about 20 to 22 cm.

Interest to Fisheries : Apparently none at present, although often taken by commercial bottom trawlers.

Literature : Fowler (1941); Smith (1949); Bass, D'Aubrey & Kistnasamy (1975); Springer (1979).

Remarks : Bass, D'Aubrey & Kistnasamy (1975) cast doubt on the identity of C. sufflans specimens recorded from the Gulf of Aden (Norman, 1939), which include an adolescent male only 30 cm long. Nominal records of this species from Viet Nam (Fourmanoir & Nhu-Nhung, 1965) are apparently based on an undescribed swellshark usually termed C. umbratile but apparently not that species (see also Bass, D'Aubrey & Kistnasamy, 1975a).

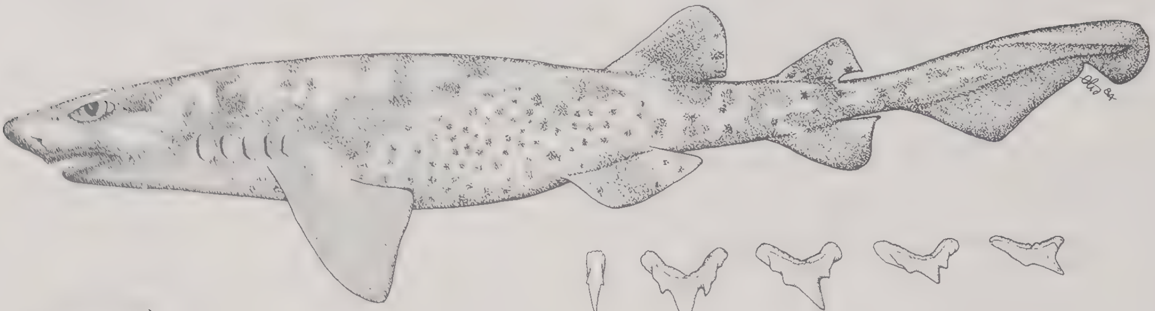
Cephaloscyllium ventriosum (Garman, 1880)

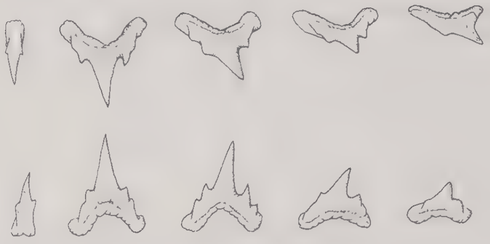
SCYL Cep 7

Scyllium ventriosum Garman, 1880, Mem.Mus.Comp.Zool.Harv.Coll., 6(11):167. Holotype: Museum of Comparative Zoology, Harvard, 740 mm adult female. Type Locality: Valparaiso, Chile.

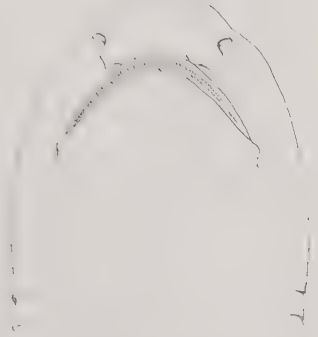
Synonymy : Catulus uter Jordan & Gilbert, in Jordan & Evermann, 1896.

FAO Names : En - Swellshark; Fr - Holbiche ventrue; Sp - Pejegato hinchado.

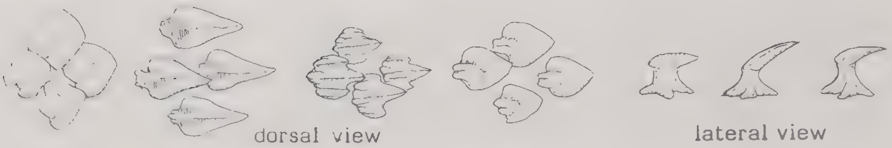




upper and lower teeth



underside of head



dorsal view

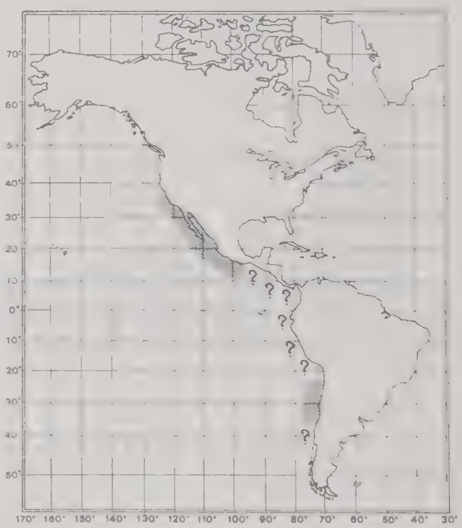
lateral view

dermal denticles

Field Marks : A large variegated catshark, with small dark and light spots, undersides spotted, no labial furrows, second dorsal smaller than first, anterior nasal flaps reaching mouth.

Diagnostic Features : Snout broadly rounded-angular in dorsoventral view, extremely short; anterior nasal flaps broadly lobate or subtriangular, overlapping mouth posteriorly. Claspers short and stout. Colour pattern of variegated dark brown blotches and saddles and numerous dark and some light spots on a yellow-brown background on body and fins, underside of head and abdomen spotted; fins without conspicuous light margins. A large species (see size below).

Geographical Distribution : Eastern Pacific: Central California (Monterey Bay) to Gulf of California and southern Mexico; central Chile.



Habitat and Biology : A sluggish, nocturnal benthic and epibenthic shark of warm-temperate and subtropical continental waters, on the continental shelves and upper slopes, with a depth range from inshore to 457 m, commonest at depths of 5 to 37 m. This species prefers rocky, algal-covered areas of kelp beds, but also occurs on algal-covered bottom without kelp. The swell shark usually spends the day lying on the bottom motionless in rocky caves and crevices but becomes active at night and swims slowly through bottom algae or in open water close to the bottom. Swellsharks may occur in aggregations of several individuals while resting, sometimes piled atop one another. This is a hardy species in captivity, and will live in tanks for several years. Under experimental conditions this species was shown to have an endogenous, circadian activity pattern that is clearly calibrated by diel changes in light.

The swellshark is oviparous and lays its eggs in large, greenish-amber, purse-shaped egg-cases, which hatch in 7.5 to 10 months depending on water temperature; the young hatch at 13 to 15 cm long. These have a double row of enlarged denticles down the back that apparently are used as an antislip rachet to aid the young to force their way out of their egg-case. Females will lay eggs in captivity.

This shark feeds on bony fishes, alive and dead, and probably crustaceans. It is hypothesized that the nocturnal activity pattern of this sluggish, slow and weak-swimming shark aids in capture of its prey. The swellshark has a huge mouth and relatively small, sharp-pointed holding teeth that can handle large prey, but the shark itself seems incapable of dashing after active prey and may specialize in catching day-active bony fishes that lie on the bottom at night and are relatively inactive and unresponsive.

This shark, like at least most others in the genus and like porcupine fishes (Diodontidae) and puffers (Tetradontidae, etc.), can greatly inflate its stomach like a balloon when disturbed or harassed, with water or air. It can expand its stomach while in a crevice, wedging itself in and making it very difficult to extract. It is harmless to people, but may bite when harassed.

Size : Maximum size at least 100 cm, adult males 82 to 85 cm, size at hatching 14 to 15 cm.

Interest to Fisheries : None at present, occasionally caught by sportsfishers and divers but probably not utilized.

Literature : Garman (1913); Roedel & Ripley (1950); Kato, Springer & Wagner (1967); Johnson & Nelson (1970); Miller & Lea (1972); Feder, Turner & Limbaugh (1974); Springer (1979).

Remarks : Kato, Springer & Wagner (1967) and Springer (1979) synonymized the swellsharks of the eastern North and South Pacific (*C. uter* and *C. ventriosum*), which is followed here.

Cephalurus Bigelow & Schroeder, 1941

SCYL Ceph

Genus : *Cephalurus* Bigelow & Schroeder, 1941, *Copeia*, 1941(2):73.

Type Species : *Catulus cephalus* Gilbert, 1892, by original designation.

Synonymy : None.

Field Marks : Dwarf, tadpole-like scyliorhinids with huge heads and slender bodies, first dorsal origin somewhat anterior to pelvic origins.

Diagnostic Features : Body strikingly tadpole-shaped, head expanded but trunk and tail slender and cylindrical, tapering to caudal fin; body very soft, semigelatinous, and thin-skinned, with weakly calcified dermal denticles; stomach not inflatable; tail short, length from vent to lower caudal origin less than half of snout-vent length. Head enlarged and considerably depressed, narrowly rounded in lateral view and not wedge-shaped; head very long, about 1/3 of total length in adults; snout very short, less than half of mouth width, thick, and flattened, bluntly pointed in lateral view; snout not expanded laterally, broadly rounded in dorsoventral view; ampullal pores not greatly enlarged on snout; nostrils of moderate size, with incurrent and excurrent apertures only partly open to exterior; anterior nasal flaps broadly triangular, without barbels, well separate from each other and falling somewhat anterior to mouth; internarial space about 1 time the nostril width; no nasoral grooves; eyes dorsolateral on head, narrow subocular ridges present below eyes; mouth angular or semiangular, moderately long, with lower symphysis well behind upper so that upper teeth are exposed in ventral view; labial furrows present along both upper and lower jaws, these very short and ending well behind level of upper symphysis of mouth; branchial region greatly enlarged, distance from spiracles to fifth gill slits 3/4 of head length; gill slits lateral on head. Two equal-sized dorsal fins present, origin of first about one-third of its base length in front of the pelvic origins; origin of second dorsal about over the anal origin; pectoral fins small, their width much less than mouth width; inner margins of pelvic fins not fused over claspers in adult males; claspers moderately long, fairly thick and distally pointed, extending well behind the pelvic fin tips; anal fin moderately large, but not greatly elongated, about as large as pelvic and dorsal fins; base length subequal to second dorsal base; origin of anal well behind pelvic bases, and its insertion separated from lower caudal origin by a broad space over half the anal base; caudal fin moderately elongated, slightly less than a fourth of total length in adults. No crest of denticles on the dorsal caudal margin; supraorbital crests absent from cranium. Colour light to dark brown, without a conspicuous colour pattern.

Remarks : Specimens of *Cephalurus* from Panama, Peru and Chile differ from the type species, *C. cephalus*, in a number of characters and may represent one or more new species (see also Kato, Springer & Wagner, 1967, and Springer, 1979).

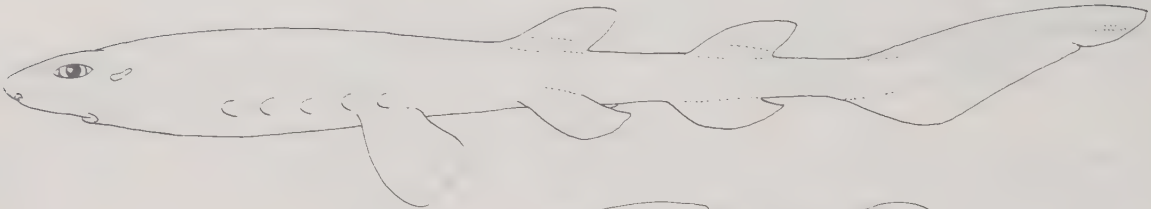
Cephalurus cephalus (Gilbert, 1892)

SCYL Ceph 1

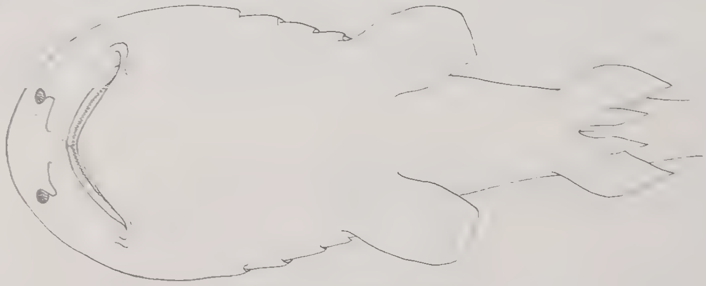
Catulus cephalus Gilbert, 1892, *Proc.U.S.Nat.Mus.*, 14(880):541. Holotype: U.S. National Museum of Natural History, USNM 125094, 243 mm adult male. Type Locality: Off Clarion Island, Revillagigedo Islands, 18°17.5'N, 114°43.3'W at 841 m depth.

Synonymy : None.

FAO Names : En - Lollipop catshark; Fr - Holbiche têtard; Sp - Pejegato renacuajo.



Field Marks : A tadpole-shaped catshark that is "all head", as suggested by its scientific name, with expanded gill region and small slender body and tail; first dorsal origin somewhat in front of pelvic origins, body extremely soft.



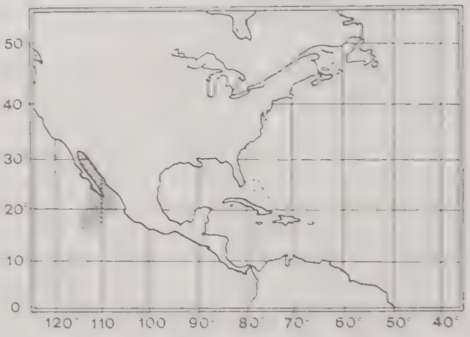
partial ventral view

Diagnostic Features : See genus.

Geographical Distribution : Eastern Pacific: Southern Baja California and Gulf of California, Mexico.

Habitat and Biology : A little-known, peculiar little shark of the upper continental slope and outermost shelf, on or near bottom at depths from 155 to 927 m; locally abundant in the Gulf of California. The expanded branchial region of this species and its relatives suggest that they are adapted to bottom areas with low dissolved oxygen levels, as is apparently the filetail catshark, Parmaturus xaniurus, and the triakid Iago omanensis.

Oviparous, one of the live-bearing scyliorhinids, with very thin-walled egg-cases that are apparently retained in the uterus until the young hatch; size of litters 2 (one egg and embryo per uterus).



Size : Maximum about 28 cm; adults maturing at about 19 cm, adult males and females up to at least 24 cm, size at birth about 10 cm. Adult Cephalurus species from Peru and Chile reach 26 to 32 cm.

Interest to Fisheries : None.

Literature : Bigelow & Schroeder (1941, 1948); Mathews & Ruiz (1974); Springer (1979).

Galeus Rafinesque, 1810

SCYL Gal

Genus : Galeus Rafinesque, 1810, Caratt.gen.sp.anim.piant.Sicilia, Palermo, Pt. 1:13.

Type Species : Galeus melastomus Rafinesque, 1810, by subsequent designation of Fowler (1908:53).

Synonymy : Subgenus Pristiurus Bonaparte, 1834 (Genus Scyllium Cuvier, 1817); Genus Pristidurus Bonaparte, 1838 (emendation of Pristiurus?); Subgenus Figaro Whitley, 1928 (Genus Pristiurus Bonaparte, 1834).

Field Marks : Usually firm-bodied scyliorhinids with caudal crests of enlarged denticles, usually rather long and wedge-shaped snouts, short labial furrows, subocular ridges virtually obsolete, large pectoral fins, large anal fin, elongated caudal fins, often barred and blotched colour pattern.

Diagnostic Features: Body not tadpole-shaped, slender and subcylindrical to rather compressed, tapering slightly to considerably to caudal fin; body firm and thick-skinned, with well-calcified dermal denticles; stomach not inflatable; tail varying from fairly short to moderately long, length from vent to lower caudal origin about 2/5 to 5/6 of snout-vent length. Head slightly depressed, narrowly pointed-rounded in lateral view and somewhat wedge-shaped or not; head short to moderately long, between 1/4 and 1/5 to less than 1/5 of total length in adults; snout fairly short, to moderately elongated, 2/3 to about equal to mouth width, thick to rather thin and flattened, bluntly to almost acutely pointed in lateral view; snout not expanded laterally, broadly to narrowly rounded-parabolic and usually bell-shaped in dorsoventral view; ampullal pores not greatly enlarged on snout; nostrils of moderate size, with incurrent and excurrent apertures only partly open to exterior; anterior nasal flaps broadly triangular and rather low, without barbels, well separate from each other and falling well anterior to mouth; internarial space about 0.7 to 1.2 times the nostril width; no nasoral grooves; eyes virtually lateral on head, subocular ridges below eyes narrow or obsolete; mouth angular or semiangular, moderately long, with lower symphysis well behind upper so that upper teeth are exposed in ventral view; labial furrows present along both upper and lower jaws, these very short to moderately long but ending well behind level of upper symphysis of mouth; branchial region not greatly enlarged, distance from spiracles to fifth gill slits 1/3 to 1/2 of head length; gill slits lateral on head. Two equal-sized dorsal fins present, origin of first varying from over the first third of the pelvic bases to about over their insertions; origin of seond dorsal varies from about over to slightly behind the anal midbase; pectoral fins large, their width somewhat less to considerably greater than mouth width; inner margins of pelvic fins not fused or variably fused and forming an 'apron' over claspers in adult males; claspers short to moderately long, fairly thick and distally pointed and often twisted, extending from less than a fifth to about half of their lengths behind the pelvic fin tips; anal fin large and more or less elongated, about as large as pelvic fins or larger, and considerably larger than the dorsals; its base length 1.6 to slightly over 3 times second dorsal base; origin of anal close to far behind pelvic bases, and its insertion separated from lower caudal origin by a narrow notch to a broad space nearly equal to the anal base; caudal fin more or less elongated, over or somewhat less than a fourth of total length in adults. A well-developed crest of denticles on the dorsal caudal margin and sometimes the upper edge of the caudal peduncle, and in some species on the preventral margin and lower edge of the caudal peduncle, dorsal crest flat on its upper surface and symmetrical; small median denticles between upper crest denticles usually in less than five rows; supraorbital crests absent from cranium. Colour light grey or brown, with or without a conspicuous colour pattern of dark saddles and blotches.

Remarks: Orkin (1952) advocated the rejection of *Galeus* Rafinesque, 1810 because of prior selection of a type species, *Galeus mustelus*, by Jordan & Evermann (1896), which antedates Fowlers' (1908) selection of *G. melastomus* Rafinesque, 1810, as the type of *Galeus*. If Orkin's recommendation is followed, *Galeus* Rafinesque, 1810 becomes a junior synonym of *Mustelus* Linck, 1792 and *Pristiurus* Bonaparte, 1834, must be used for this genus. As a present expedient I prefer to follow Fowler's type designation because *G. melastomus* is the only species of *Galeus* mentioned in Rafinesque's (1810) account that has a description. The other three species, *Galeus vulpecula*, *G. mustelus* and *G. catulus*, although "identifiable" (Orkin, 1952), are mentioned in name only, without references or characters. Since *Galeus* has received considerable usage since Bigelow & Schroeder's (1948) review of the genus (up to and including its recent revision by Springer, 1979), continued use of *Galeus* is preferable to its substitution by *Pristiurus* for promoting nomenclatural stability. *Pristiurus* has had considerable usage in the older literature.

The subgenus *Figaro* was proposed by Whitley (1928) for a new Australian catshark, *Pristiurus boardmani* that differed from well-known species of *Galeus* by having an additional crest of enlarged denticles on the preventral caudal margin. Whitley (1939) raised the rank of *Figaro* to genus, but Fowler (1941) and Bigelow & Schroeder (1948) synonymized it with *Galeus*. Springer (1966) recognized *Figaro* without comment, but later included it in *Galeus*. Recently Chu *et al.* (1983) revived *Figaro* for *Pristiurus boardmani* Whitley, 1928, *Dichichthys melanobranchius* Chan, 1966, and the new *Figaro piceus* Chu *et al.* 1983 (a possible synonym of *D. melanobranchius*); they defined the genus primarily by its subcaudal denticle crest. Two additional species have subcaudal crests: *Pristiurus murinus* Collett, 1904, usually placed in *Galeus*; and *Parmaturus pilosus* Garman, 1906, the type-species of the genus *Parmaturus*. If all these species are placed in the genus *Figaro* it becomes a heterogeneous assemblage defined by a single character; moreover, *Figaro* becomes a junior synonym of *Parmaturus*, and species of *Parmaturus* without the subcaudal crest (*P. xaniurus* and *P. campechensis*) become orphans, even though they are phenetically more similar to *P. pilosus* and *D. melanobranchius* than to *P. boardmani*. Hence a temporary solution to the problem, that advocated by Springer (1979), is adopted here: to not recognize *Figaro* and include *P. boardmani* in *Galeus* and *D. melanobranchius* and *F. piceus* in *Parmaturus*.

The problem with Springer's (1979) arrangement is that *Galeus* and *Parmaturus* may ultimately prove to be generically inseparable. Although typical species of *Galeus*, such as *G. melastomus*, are strongly differentiated from typical *Parmaturus* such as *P. pilosus*, some of the other species in these genera, including *G. boardmani*, *G. murinus*, *G. schultzi*, and *P. melanobranchius*, are more or less intermediate. Hence the characters separating these genera as given in the key to genera and in the diagnostic features may not work for all species.

Reviews of this genus are in Bigelow & Schroeder (1948), Springer (1966), Springer & Wagner (1966), and Springer (1979). There may be an undescribed species of *Galeus*, of more typical form than *G. boardmani*, in Australian waters.

Key to Species

1a. A crest of denticles present on the preventral caudal margin as well as the dorsal margin

2a. Pelvic fins very large and broadly rounded. Colour plain .... G. murinus

2b. Pelvic fins moderately large and angular. A colour pattern of saddles and bars present .... G. boardmani

1b. No crest of denticles on the preventral caudal margin

3a. Labial furrows very short, confined to mouth corners. Snout broadly rounded, usually considerably less than mouth width .... G. schultzi

3b. Labial furrows more elongated, extending well beyond mouth corners. Snout more angular and pointed, usually nearly equal to, or about equal to mouth width

4a. Dorsal fins and sometimes upper and lower caudal lobes with black tips .... G. sauteri

4b. Dorsal and caudal fins without black tips, usually edged with white

5a. Mouth lining white, indistinct saddle markings present or absent from body. Base of precaudal tail fairly low and cylindrical

6a. Distance from tip of snout to incurrent aperture of nostril greater than eye length. Anal base shorter than space between pelvic and anal bases .... G. nipponensis

6b. Distance from tip of snout to incurrent aperture of nostril less than eye length. Anal base longer than space between pelvic and anal bases .... G. eastmani

5b. Mouth lining usually black, bold saddle markings usually present on body (absent in some G. piperatus). Base of precaudal tail fairly high and compressed

7a. Dorsal saddle blotches on back 15 to 18. Free rear tip of anal fin reaches or extends past lower caudal origin. A large species, adults over 50 cm .... G. melastomus

7b. Saddle blotches when present, usually 11 or less. Free rear tip of anal fin falling in front of lower caudal origin. Smaller species, adults less than 45 cm

8a. Snout more elongated, preoral snout 7.4 to 8.5% of total length. Mouth longer and more narrowly arched. Saddle blotches grey or blackish grey .... G. polli

8b. Snout shorter, preoral snout 5.8 to 7.8% of total length. Mouth shorter and more broadly arched. Saddle blotches, when present, brown

9a. Monospondylous precaudal centra 29 to 33 .... G. piperatus

9b. Monospondylous precaudal centra 33 to 39 .... G. arae

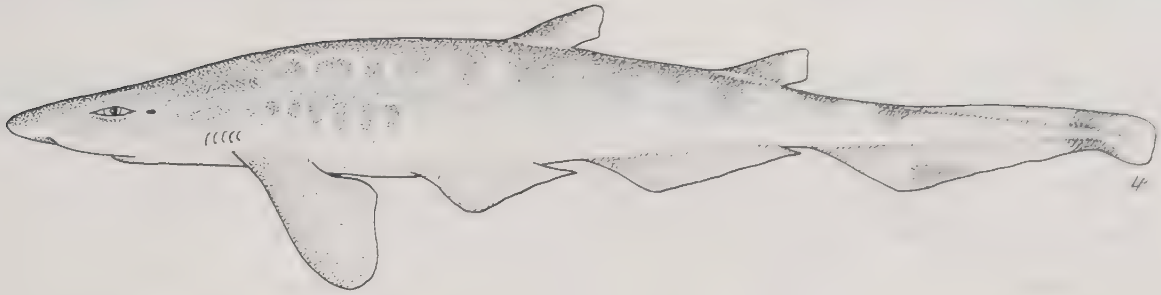
Galeus arae (Nichols, 1927)

SCYL Gal 2

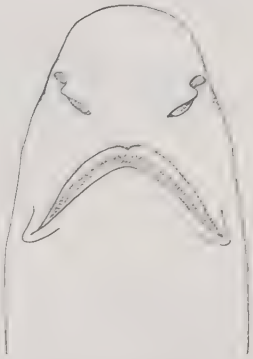
Pristiurus arae Nichols, 1927, American Mus.Novit., (256):1, fig. 1. Holotype: American Museum of Natural History, New York, AMNH 8677, 159 mm, immature female. Type Locality: Off Miami Beach, Florida, in 366 m depth.

Synonymy : Galeus cadenati Springer, 1966; Galeus arae antillensis Springer, 1979.

FAO Names : En - Roughtail catshark; Fr - Chien à queue rude; Sp - Pintarroja rabolija.



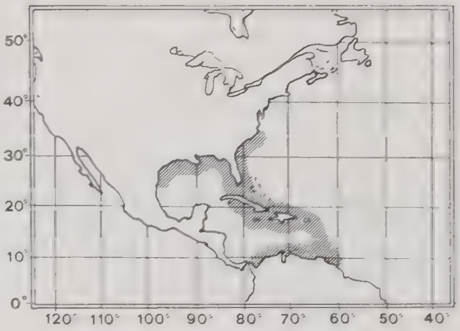
Field Marks : See diagnostic features and key to species.



underside of head

Diagnostic Features : Precaudal tail noticeably compressed at base. Snout moderately long and pointed, preoral length about 5 to 7% of total length; prenarial snout equal or greater than eye length; eyes virtually lateral on head, without prominent subocular ridges; mouth fairly large but short, very broadly arched, its width 6.2 to 9.1% of total length; labial furrows moderately long, not confined to mouth corners. Pelvic fins small, low, and angular; interspace between pelvic and anal bases much shorter than anal base; anal base short to long, 10 to 15% of total length, less than or slightly greater than interdorsal space, its origin varying from under midlength of interdorsal to just behind first dorsal insertion; no subcaudal crest of enlarged denticles on preventral caudal margin. A colour pattern of variegated dark saddled blotches on body and dark bands on caudal fin, saddles varying from well-defined and outlined with whitish to obscure, when present, usually less than 11 in number; usually additional dark markings on flanks; dorsal fins and caudal tip without black terminal marking; mouth lining dark. Monospondylous precaudal centra 33 to 39. Size small to moderate, adults up to about 40 cm.

Geographical Distribution : Western North Atlantic: South Carolina to Florida, northern Gulf of Mexico, Cuba, Hispanola, Puerto Rico, Jamaica, the Lesser Antilles, and Caribbean coast from Belize to Colombia.



Habitat and Biology : An abundant warm-temperate and tropical, deepwater bottom-dwelling shark of the western Atlantic upper continental and insular slopes on or near bottom at 292 to 732 m depth; rarely specimens occur over the edge of the Caribbean insular shelf in waters up to 142 m depth. Water temperatures at capture sites were between about 4.6 to 11.1°C. This shark is irregularly distributed along the narrow band of slope it inhabits, sometimes occurring in hundreds and sometimes not at all in trawl hauls over suitable habitat. There is partial segregation by depth, adults but very few juveniles being found below 450 m but with mixed adults and juveniles in shoaler waters less than 450 m.

Mode of development uncertain; possibly oviparous in the Caribbean island subspecies *G. a. antillensis*, but possibly ovoviviparous in the continental *G. a. arae*.

Apparently eats mainly deepwater shrimp.

Size : Maximum about 43 cm, adult males 27 to 36 cm, adult females, 26 to 43 cm.

Interest to Fisheries : None at present.

Literature : Springer (1966, 1979); Springer & Wagner (1966); Bullis (1967).

Remarks : Springer (1979) recognizes three subspecies of this species from adjacent areas: *G. a. arae* from south Carolina to Florida, northern Gulf of Mexico, and the Caribbean coast from Belize to Nicaragua; *G. a. antillensis* from the northern slopes of Cuba, Hispaniola, Puerto Rico, Jamaica, and many of the Leeward Islands of the Caribbean southward to Martinique; and *G. a. cadenati* from Panama and Colombia. *G. a. cadenati* was formerly considered a full species (Springer, 1966), but later reduced to a subspecies of *G. arae* (see Springer, 1979).

Galeus boardmani (Whitley, 1928)

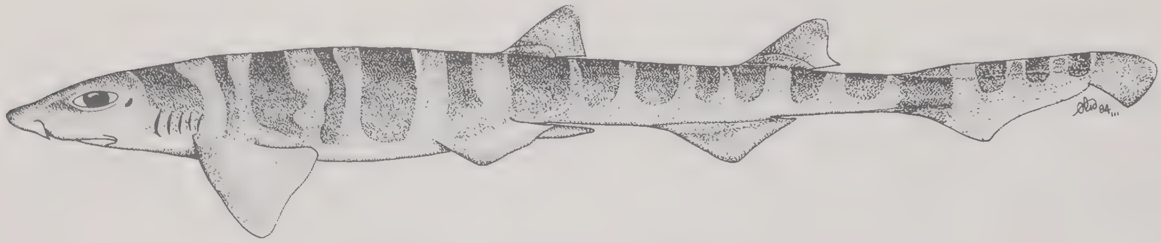
SCYL Gal 3

Pristiurus (*Figaro*) *boardmani* Whitley, 1928, *Rec.Aust.Mus.* 16(4):238, pl. 18, fig. 3. Holotype: Australian Museum, Sydney, AMS IA.2483, 540 mm adult male. Type Locality: NNE of Montague Island, New South Wales, Australia, depth of 165 m.

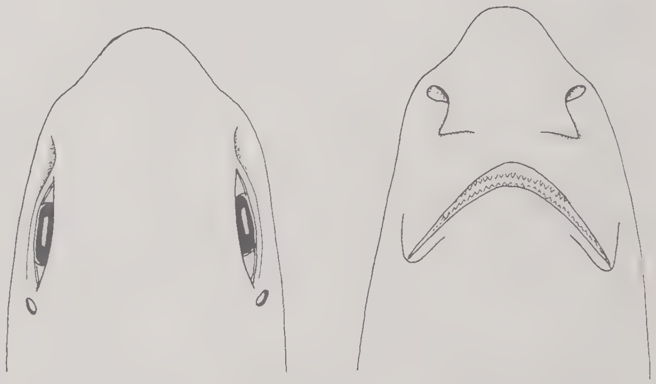
Synonymy : *Figaro boardmani socius* Whitley, 1939.

Other Scientific Names Recently in Use : *Figaro boardmani* (Whitley, 1928).

FAO Names : En - Australian sawtail catshark; Fr - Chien égoïne; Sp - Pintarroja australiana.



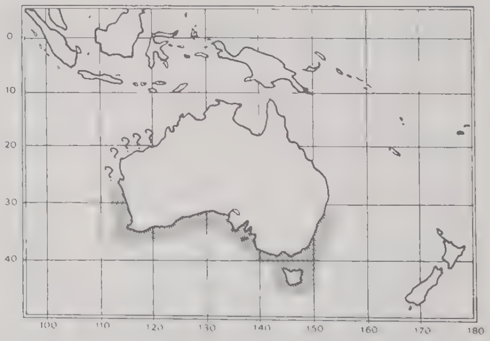
Field Marks : The only scyliorhinid with a double caudal crest and prominent saddle markings.



dorsal view of head

underside of head

Diagnostic Features : Precaudal tail not compressed at base. Snout moderately long and subangular, preoral length about 7% of total length; eyes dorsolateral on head, with narrow subocular ridges; mouth fairly large and long, broadly arched, its width about 8% of total length; labial furrows moderately long, not confined to mouth corners. Pelvic fins small, low, and angular; interspace between pelvic and anal bases subequal to anal base; anal base short, 11% of total length, less than interdorsal space; a well-developed subcaudal crest of enlarged denticles on preventral caudal margin, extending onto ventral surface of caudal peduncle. A colour pattern of variegated dark, saddle blotches on body and dark bands on caudal fin, saddles well-defined and outlined with whitish; saddled blotches usually present on back and tail and 12 or 13 in number; no additional dark spots on flanks; dorsal fins and caudal tip without black terminal marking; mouth lining light. Size moderate, adults to 61 cm.



Geographical Distribution : Western South Pacific and eastern Indian Ocean: southern coasts of Australia from New South Wales, Victoria, Tasmania, South and Western Australia.

Habitat and Biology : A little-known but common Australian catshark of temperate and subtropical waters, from the outer continental shelf and upper slope, presumably on or near bottom at depths from 128 to 823 m.

Size : Maximum about 61 cm, males mature at 54 cm.

Interest to Fisheries : None?

Literature : Whitley (1939, 1940); Fowler (1941); Springer (1979).

Remarks : The writer examined the holotype in the Australian Museum (Sydney), from which the illustration is derived. The species differs from some other species of *Galeus*, including *G. arae*, *G. melastomus*, *G. murinus*, *G. eastmani*, and *G. sauteri*, in lacking twisted terminal tips on its claspers. Whitley (1939, 1940) considered specimens from the Great Australian Bight as a separate subspecies, *Figaro boardmani socius*; this was based on apparent differences in colour pattern from typical *boardmani* from New South Wales.

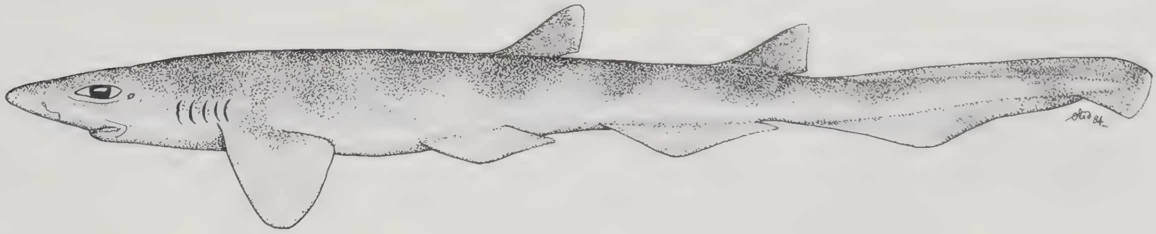
Galeus eastmani (Jordan & Snyder, 1904)

SCYL Gal 3

Pristiurus eastmani Jordan & Snyder, 1904, *Smithson.Misc.Collect.*, 45:230, pl. 60. Holotype: Stanford University SU-7740, 345 mm female. Type Locality: Off Izu, Japan.

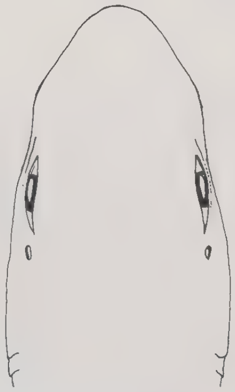
Synonymy : None.

FAO Names : En - Gecko catshark; Fr - Chien gecko; Sp - Pintarroja salamanquesa.

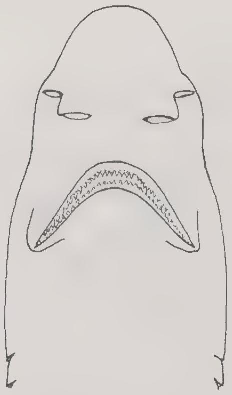


Field Marks : *Galeus* with light mouth, long and narrow snout, prenarial snout shorter than eye, no subcaudal crest, obscure colour pattern, slender body, and small anal fin.

Diagnostic Features : Precaudal tail not greatly compressed as base. Snout moderately long and narrowly parabolic, preoral length about 5 to 6% of total length; prenarial snout shorter than eye diameter; eyes virtually lateral on head, with slight subocular ridges; mouth moderately large and long, broadly arched, width about 6% of total length; labial furrows moderately long, not confined to mouth corners. Pelvic fins small, low and angular; interspace between pelvic and anal bases much shorter than anal base; anal fin short, its base about 12% of total length and much shorter than interdorsal space; anal origin under anterior half of interdorsal space. No subcaudal crest of enlarged denticles on preventral caudal margin. A colour pattern of obscure dark saddle blotches on body and caudal fin, dorsal fins and caudal tip whitish; mouth lining light. Monospondylous precaudal centra 33 to 36. Size small, adults to at least 40 cm.



dorsal view of head



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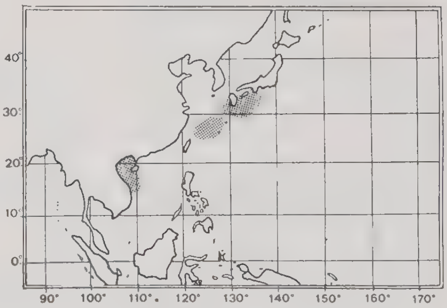
Geographical Distribution : Western North Pacific: Japan, East China Sea, Viet Nam.

Habitat and Biology : A little-known, but very common small shark in Japanese waters, found in deep water near the bottom. Development oviparous, with a single egg laid per oviduct. In Japanese waters this species shows sexual segregation, with reported schools of mostly females. Egg-case 6 x 1.6 cm.

Size : Possibly to 50 cm maximum, adult males maturing at about 31 to 32 cm and reaching at least 36 cm; adult females maturing at about 36 to 37 cm and reaching at least 40 cm.



Interest to Fisheries : None at present.

Literature : Springer & Wagner (1966); Nakaya (1975); Springer (1979).

Remarks : The illustration is taken from the holotype.

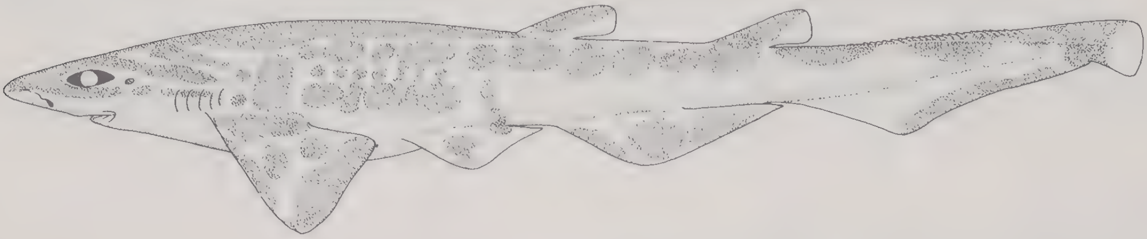
Galeus melastomus Rafinesque, 1810

SCYL Gal 1

Galeus melastomus Rafinesque, 1810, Caratt.gen.sp.anim.piant.Sicilia, Palermo, pt. 1:13. Holotype: None. Type Locality: Sicily.

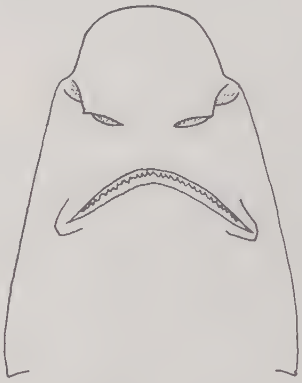
Synonymy : Squalus (Scyliorhinus) delarochianus Blainville, 1816 (name only) also Blainville, 1825; Scyllium artedii Risso, 1820; Squalus prionurus Otto, 1821; Squalus annulatus Nilsson, 1832; Scyllium melanostomum Bonaparte, 1834; Pristiurus souverbiei LaFont, 1866 (1868?); ? Pristiurus atlanticus Vaillant, 1888.

FAO Names : En - Blackmouth catshark; Fr - Chien espagnol; Sp - Pintarroja bocanegra.



Field Marks : A large Galeus with long anal fin, compressed precaudal tail, striking colour pattern of numerous dark saddles and circular spots.

Diagnostic Features : Precaudal tail with base noticeably compressed. Snout moderately long and pointed, preoral length about 6 to 9% of total length; prenarial snout equal or less than eye length; eyes lateral on head, subocular ridges obsolete; mouth fairly large and short, very broadly arched, its width 6 to 8% of total length; labial furrows moderately long, not confined to mouth corners. Pelvic fins small, low, and angular; interspace between pelvic and anal bases much shorter than anal base; anal base long, 13 to 18% of total length, much greater than interdorsal space; its origin well in front of midlength of interdorsal space; no subcaudal crest of enlarged denticles on preventral caudal margin. A colour pattern of well-defined, variegated dark saddle blotches and circular spots on body and caudal fin; saddles over 15 on back and tail; dorsal fins and caudal tip white; mouth lining dark. Monospondylous precaudal centra 37 to 43. Size moderate, adults up to 90 cm.



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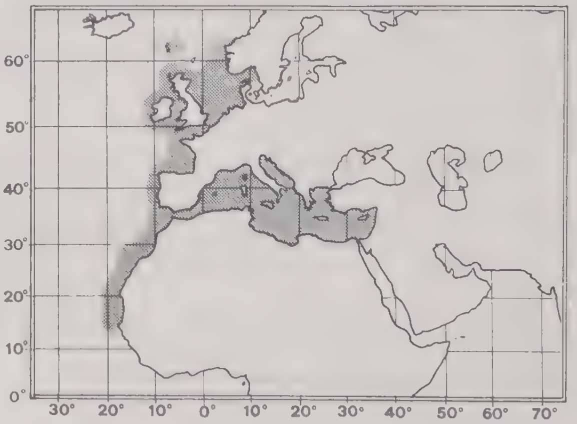
Geographical Distribution : Eastern North Atlantic: Faeroe Islands and Trondheim, Norway southward to Senegal, also Mediterranean Sea.

Habitat and Biology : A common deepwater bottom-dwelling shark found on the outer continental shelves and upper slopes, mainly between 200 and 500 m, but occasionally up to 55 m and down to 1000 m depth.

Oviparous, with up to 13 eggs present in the oviducts of a female at one time; egg-cases about 6 by 3 cm.

Feeds mainly on bottom invertebrates, including shrimps and cephalopods, but also on small mesopelagic bony fishes (lanternfishes) and other small elasmobranchs.



Size : Maximum 90 cm; males maturing between 34 and 42 cm and reaching at least 61 cm, females maturing between 39 and 45 cm and reaching 90 cm.

Interest to Fisheries : Limited, in the eastern North Atlantic caught in bottom trawls and utilized fresh and dried-salted for human consumption, and for leather.

Literature : Tortonese (1956); Springer & Wagner (1966); Wheeler (1978); Springer (1979); Compagno (1981).

Galeus murinus (Collett, 1904)

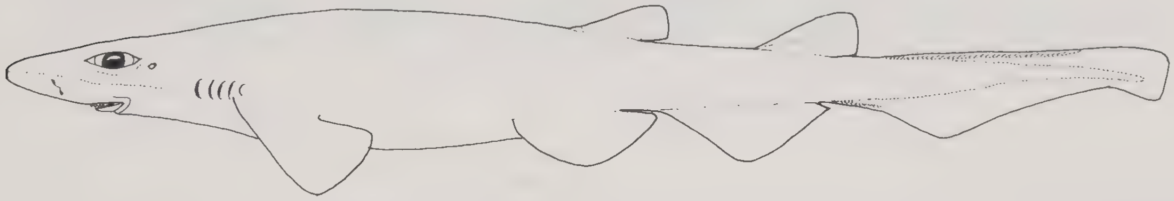
SCYL Gal 5

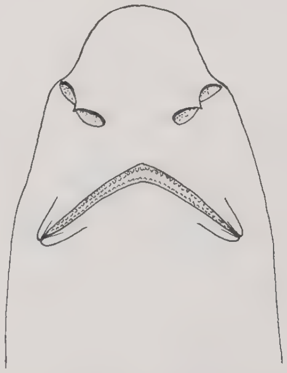
Pristiurus murinus Collett, 1904, Christiania Vidensk.Selskl.Forhand., 1904, (9):4. Holotype: Zoologisok Museum, Oslo, Norway, ZMO Michael Sars stn. 76, 222 mm, immature female. Type Locality: Eastern Atlantic, Faeröe Channel at 1200 m.

Synonymy : Pristiurus jenseni Saemundsson, 1922.

Other Scientific Names Recently in Use : Galeus melastomus murinus (see Springer, 1979).

FAO Names : En - Mouse catshark; Fr - Chien islandais; Sp - Pintarroja islándica.





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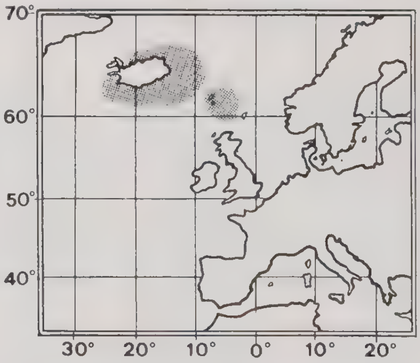
Field Marks : A Galeus with large round pelvic fins, a cylindrical precaudal tail, a subcaudal crest of denticles, and no colour pattern.

Diagnostic Features : Precaudal tail not noticeably compressed at base. Snout moderately long and parabolic, preoral length about 7 to 8% of total length; prenarial snout less than eye length; eyes slightly dorsolateral, subocular ridge very narrow; mouth fairly large and long, broadly arched; its width 7 to 8% of total length; labial furrows moderately long, not confined to mouth corners. Pelvic fins very large, high, and broadly rounded; interspace between pelvic and anal bases much shorter than anal base; anal base short, about 12 to 13% of total length, but much greater than interdorsal space; anal origin just behind first dorsal insertion; a strong subcaudal crest of enlarged denticles on preventral caudal margin and underside of caudal peduncle. Colour uniform brown above, slightly lighter below, without black tips on dorsal and caudal fins; mouth lining dark. Size moderate, adults to at least 63 cm.



Geographical Distribution : Eastern North Atlantic: Iceland and Faeroes.

Habitat and Biology : A little-known, but moderately common deepwater shark of the eastern Atlantic continental slopes, on or near the bottom at depths from 475 to 1200 m.

Size : Maximum at least 63 cm (adult male).

Interest to Fisheries : None.

Literature : Springer & Wagner (1966); Springer (1979).

Remarks : Springer (1979) recently placed this species in synonymy of G. melastomus, ranking it as a subspecies (G. melastomus murinus). However, the author's examination of series of murinus in the collections of the Institut für Seefischerei, Hamburg, and comparison of them with G. melastomus indicates that these two species are distinct. Adult G. murinus differs from adult G. melastomus in having longer labial furrows, a broader internarial space, a broader and blunter head, smaller pectoral fins, less elongated, more broadly rounded anal and pelvic fins, a more anterior first dorsal origin, a longer trunk and shallower caudal peduncle, a second caudal crest of enlarged denticles on the preventral caudal margin (as in G. boardmani but unlike other species of Galeus), and no dark blotches on sides. The author follows Springer (1973, 1979) in synonymizing G. jenseni with this species.

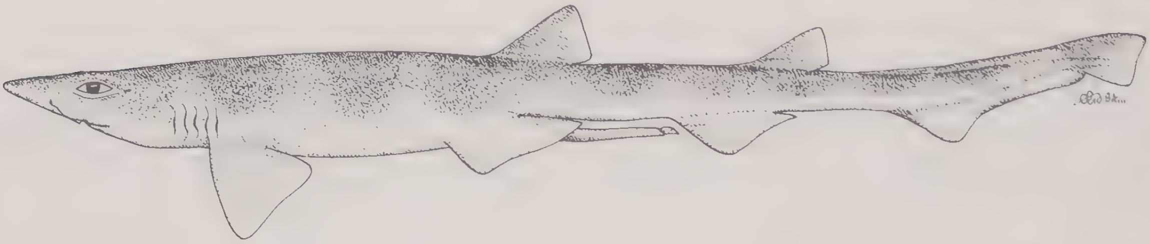
Galeus nipponensis Nakaya, 1975

SCYL Gal 6

Galeus nipponensis Nakaya, 1975, Mem.Fac.Fish.Hokkaido Univ., 23(1):51, figs. 26-28. Holotype: Hokkaido University Laboratory of Marine Zoology, HUMZ 40012, 596 mm adult male. Type Locality: Mimase, Kochi Prefecture, Honshu, Japan.

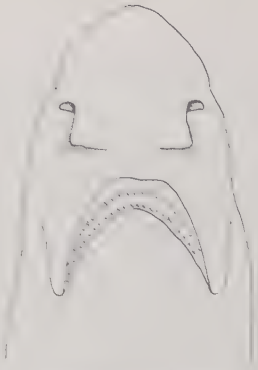
Synonymy : None.

FAO Names : En - Broadfin sawtail catshark; Fr - Chien planeur; Sp - Pintarroja nipona.



Field Marks : A large Galeus with an unusually short anal fin, long space between anal and pelvic bases, prenarial snout longer than the eyes, and, in males, slender, greatly elongated claspers.

Diagnostic Features : Precaudal tail not noticeably compressed at base. Snout moderately long and pointed, preoral length about 7% of total length; prenarial snout greater than eye length; eyes probably nearly lateral, with subocular ridges obsolete; mouth fairly large and long, broadly arched, its width 6 to 8% of total length; labial furrows moderately long, not confined to mouth corners. Pelvic fins large, low, and angular; interspace between pelvic and anal bases considerably longer than anal base; anal base short, 8 to 10% of total length, much less than interdorsal space; its origin varying from below to behind midlength of interdorsal; no subcaudal crest of enlarged denticles on preventral caudal margin. A variegated colour pattern of obscure and poorly defined dark saddle blotches on body and caudal fin; dorsal and caudal fins without black tips; mouth lining light. Monospondylous precaudal centra 33 to 36. Size moderate, adults up to about 66 cm.



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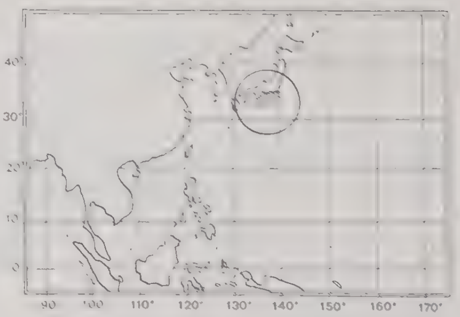
Geographical Distribution : Western North Pacific: Southeastern Honshu, Japan.



Habitat and Biology : A common, probably deepwater bottom shark of Japan. Oviparous, possibly with a single egg laid per oviduct. There is an interesting sexual dimorphism in adults of this shark, the anal fins of males being about 2% of total length shorter than females, which was thought by Nakaya (1975) to be related to the function of the unusually long claspers of this shark, which presumably need more clearance of the anal fin than such species as G. eastmani and G. sauteri, which have much shorter claspers and lack the sexual dimorphism in anal length.

Size : Adults maturing at about 53 to 55 cm; largest reported 65.6 cm.

Interest to Fisheries : Not known.

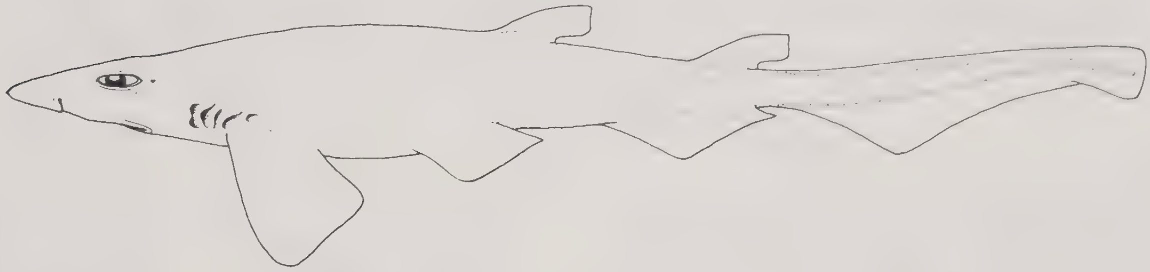
Literature : Nakaya (1975); Springer (1979).

Galeus piperatus Springer & Wagner, 1966

Galeus piperatus Springer & Wagner, 1966, Contrib.Sci.L.A. County Mus., (110):1, fig. 1-2. Holotype: Los Angeles County Museum of Natural History, LACM 7552, 302 mm adult female. Type Locality: 28°55'N, 112°50.5'W, midway between Tiburon and Angel de la Guardia Island, Gulf of California, probably 402 to 412 m depth.

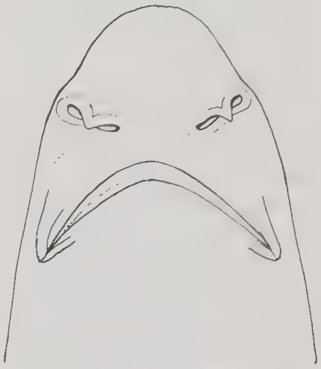
Synonymy : None.

FAO Names ; En - Peppered catshark; Fr - Chien poivré; Sp - Pejegato pimienta.



Field Marks : See diagnostic features and key to species.

Diagnostic Features : Precaudal tail noticeably compressed at base. Snout moderately long and pointed, preoral length about 5.8 to 8.6% of total length; prenarial snout equal or greater than eye length; eyes virtually lateral, subocular ridge obsolete; mouth fairly large and long, broadly arched, its width 8.3 to 13.2% of total length; labial furrows moderately long, not confined to mouth corners. Pelvic fins small, low, and angular; interspace between pelvic and anal bases much shorter than anal base; anal base short to long, 10.8 to 13.4% of total length, less than, or slightly greater than interdorsal space, its origin under first third of interdorsal; no subcaudal crest of enlarged denticles on preventral caudal margin. Colour plain in adults, variegated dark saddle blotches with white edging on body and caudal fin of young; dorsal fins and caudal without black tips; mouth lining usually dark. Monospondylous precaudal centra 30 to 33. Size small, adults up to about 30 cm.



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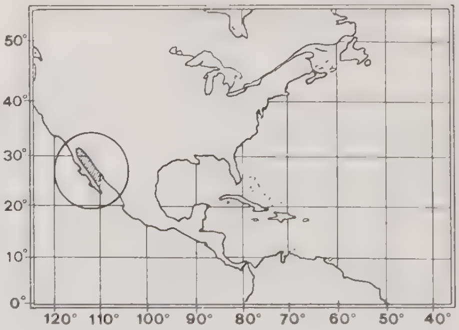
Geographical Distribution : Eastern North Pacific: Northern Gulf of California.

Habitat and Biology : A deepwater bottom-dwelling shark of the northern Gulf of California, at depths of 402 to 1326 m. Possibly oviparus.

Size : Maximum 30 cm; adult males 28 to 29 cm, adult females 26 to 30 cm; size at hatching below 7 cm.

Interest to Fisheries : None at present.

Literature : Springer & Wagner (1966); Hubbs & Taylor (1969); Springer (1979).



Remarks : G. piperatus is hardly separable from the G. arae complex of subspecies from the western Atlantic, though the author follows Springer (1979) in retaining it on vertebral count and colour differences.

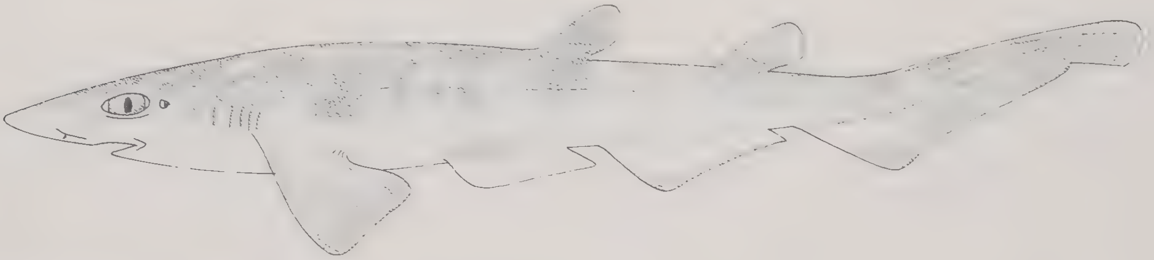
Galeus polli Cadenat, 1959

SCYL Gal 8

Galeus polli Cadenat, 1959, *Bull.Inst.Fondam.Afr.Noire (A Sci.Nat.)*, 21(1):396, figs 1-4, 7-17. Holotype: In Museum National d'Histoire Naturelle, Paris? Paratypes or syntypes, MNHN 1959-44 and 1959-45. Type Locality: Senegal.

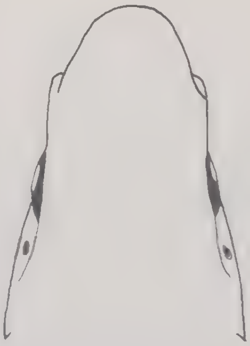
Synonymy : ? *Pristiurus atlanticus* Vaillant, 1888.

FAO Names : En - African sawtail catshark; Fr - Chien râpe; Sp - Pintarroja africana.

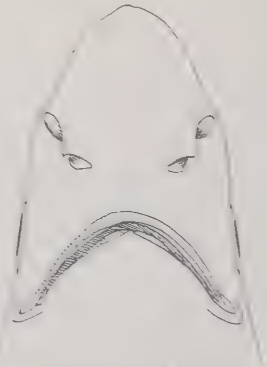


Field Marks : See diagnostic features and key to species.

Diagnostic Features : Precaudal tail with base somewhat compressed. Snout long and pointed, preoral length about 7 to 9% of total length; prenarial snout virtually equal to eye length; eyes lateral on head, subocular ridge virtually obsolete; mouth fairly large and long, broadly arched, its width 7 to 8% of total length; labial furrows moderately long, not confined to mouth corners. Pelvic fins small, low, and angular; interspace between pelvic and anal bases much shorter than anal base; anal fin long, 14 to 17% of total length, much greater than interdorsal space; its origin just behind first dorsal insertion; no subcaudal crest of enlarged denticles on preventral caudal margin. A colour pattern of variegated dark saddle blotches on body and caudal fin, saddles well-defined and outlined with whitish, usually about 11 or less on back and tail; dorsal fins and caudal fin without black tips; mouth lining dark. Monospondylous precaudal centra 32 to 35. Size small to moderate, adults up to about 40 cm.



dorsal view of head



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Geographical Distribution : Eastern central Atlantic: Southern Morocco to Namibia.

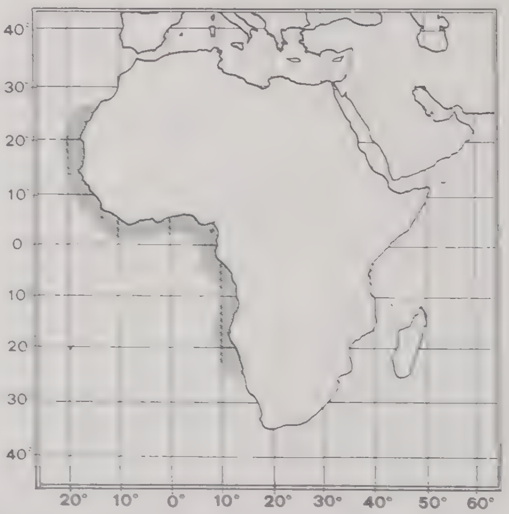
Habitat and Biology : A tropical deepwater bottom-dwelling shark, on the upper continental slope at 200 to 720 m depth.

Size : Maximum about 42 cm, adult males 35 to 39 cm, adult females 41 to 42 cm, size at birth about 12 cm.

Interest to Fisheries : Limited, caught in bottom trawls and utilized fresh for human consumption and for fishmeal.

Literature : Poll (1951); Springer (1966, 1979); Springer & Wagner (1966).

Remarks : Vaillant's (1888) description of his *Pristiurus atlanticus* from off Cape Spartel, Morocco suggests this species rather than *G. melastomus* in certain features, including its coloration and narrower internarial space; however, the type locality is somewhat north of the northernmost known occurrence of *G. polli* and the holotype of *P. atlanticus* (a female) is slightly larger (44 cm) than the largest reported *G. polli*. Garman (1913) synonymized *P. atlanticus* with *G. melastomus*, but the validity of this action is questionable pending a reexamination of the type of *P. atlanticus*, MNHN 84-387.



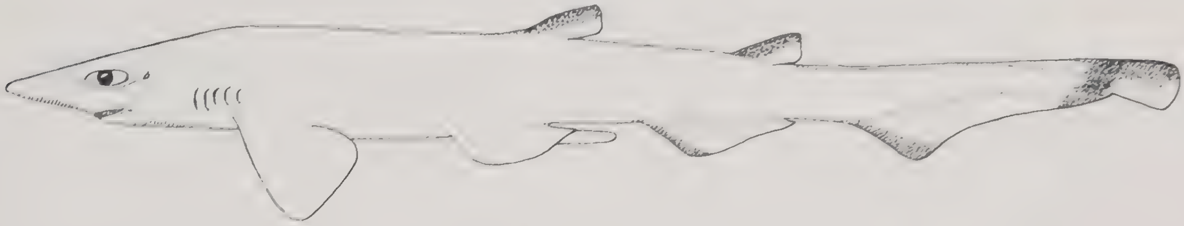
Galeus sauteri (Jordan & Richardson, 1909)

SCYL Gal 9

Pristiurus sauteri Jordan & Richardson, 1909, Mem.Carnegie Mus., 4(4):160, pl. 63, fig. 1. Syntypes: Of 6 specimens mentioned in the original description of this species, 4 are apparently still extant: Stanford University, SU 21261, 4 adult males, 364, 367 (2) and 370 mm long. Type Locality: Takao (Taiwan Island).

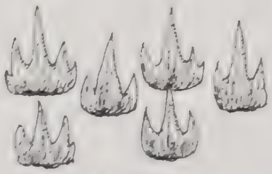
Synonymy : None.

FAO Names : En - Blacktip sawtail catshark; Fr - Chien lime; Sp - Pintarroja rabonegro.

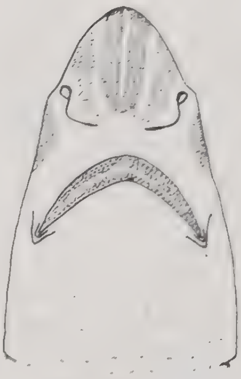


Field Marks : A Galeus with black-tipped dorsal and caudal fins.

Diagnostic Features : Precaudal tail somewhat compressed at base. Snout moderately long and pointed, preoral length about 6 to 7% of total length; prenarial snout less than eye length; eyes virtually lateral on head, subocular ridges obsolete; mouth fairly large and long, broadly arched, its width 6.2 to 9.1% of total length; labial furrows moderately long, not confined to mouth corners. Pelvic fins small, low and angular; interspace between pelvic and anal bases much shorter than anal base; anal base long, 12 to 15% of total length, less than or slightly greater than interdorsal space; origin just behind first dorsal insertion; no subcaudal crest of enlarged denticles on preventral caudal margin. No colour pattern of dark saddle blotches on body and caudal fin; dorsal fins and caudal tip with black terminal marking; mouth lining light. Monospondylous precaudal centra 31 to 34. Size small to moderate, adults up to about 40 cm.



teeth



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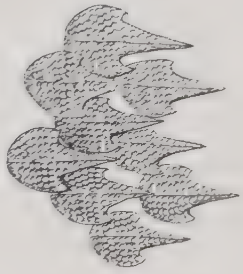


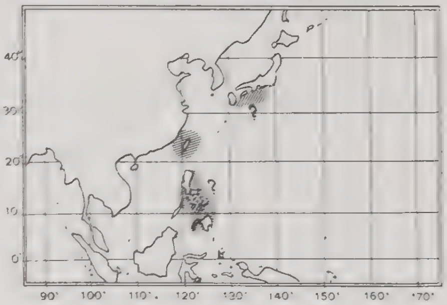
dermal denticles

Geographical Distribution : Western North Pacific: China (Taiwan Island only), possibly the Philippines and Japan.

Habitat and Biology : A little-known bottom-dwelling catshark of the continental shelves, offshore at depths of 60 to 90 m in the Taiwan Straits, but possibly deeper elsewhere. Apparently oviparous.

Size : Maximum 45 cm, adult males 36 to 38 cm, adult females 42 to 45 cm.

Interest to Fisheries : Limited, taken by bottom trawlers in Taiwan Straits.



Literature : Fowler (1941); Teng (1962); Chen (1963); Nakaya (1975); Springer (1979).

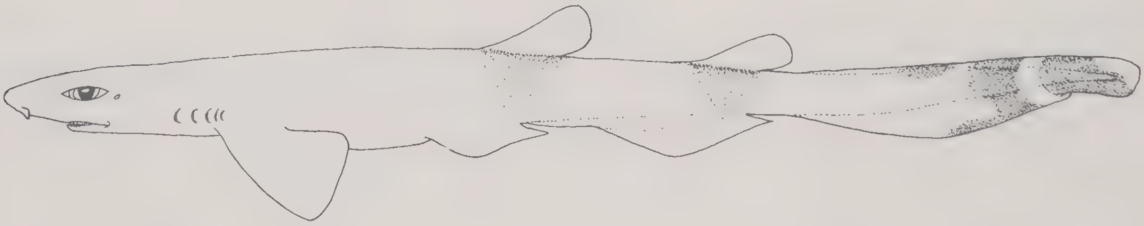
Galeus schultzi Springer, 1979

SCYL Gal 10

Galeus schultzi Springer, 1979, NOAA Tech.Rep.NMFS Circ., (422):67. Holotype: U.S. National Museum USNM-122312, 297 mm adult male. Type Locality: Balayan Bay, Luzon, the Philippines, western Pacific, 329 m depth.

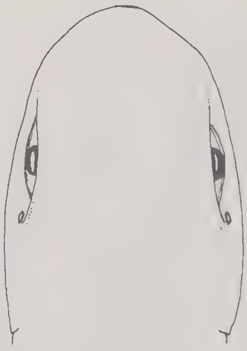
Synonymy : None.

FAO Names : En - Dwarf sawtail catshark; Fr - Chien nain; Sp - Pintarroja enana.

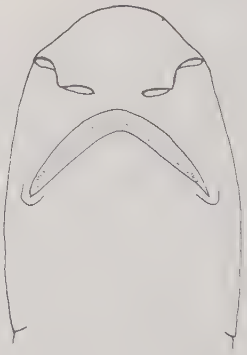


Field Marks : A Galeus with an unusually short and rounded snout and very short labial furrows, confined to mouth corners.

Diagnostic Features : Precaudal tail not noticeably compressed at base. Snout short and rounded, preoral length about 5 to 6% of total length; prenarial snout much less than eye length; eyes dorsolateral, with low subocular ridges below them; mouth fairly large and long, broadly arched, width 6.2 to 9.1% of total length; labial furrows extremely short, essentially confined to mouth corners. Pelvic fins small, low, and angular; interspace between pelvic and anal bases much shorter than anal base; anal base short, 10 to 11% of total length, greater than interdorsal space; its origin just behind first dorsal insertion; no subcaudal crest of enlarged denticles on preventral caudal margin. A colour pattern of obscure dark saddle blotches at first and second dorsal bases, and two bands on the tail; dorsal fins and caudal tip without black terminal marking; mouth lining light or dusky. Monospondylous precaudal centra 32 to 33. Size very small, adults less than 30 cm.



dorsal view of head



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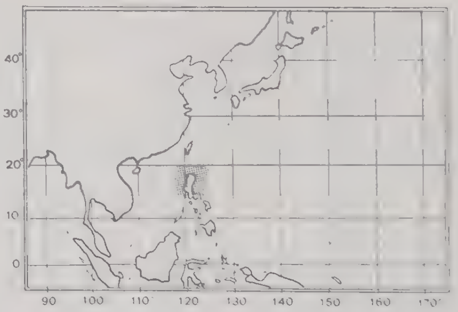
Geographical Distribution : Off Luzon, the Philippines, western Pacific:

Habitat and Biology : A little-known bottom-dwelling shark of the continental slopes at depths of 329 to 431 m.

Size : One of the smallest sharks, females mature at 26.8 to 29.7 cm, males at 25.4 cm.

Interest to Fisheries : None.

Literature : Springer (1979).



Halaelurus Gill, 1862

Genus : Halaelurus Gill, 1862, Ann.Lyceum Nat.Hist.N.Y., 7(32):407-12.

Type Species : "Halaelurus burgeri Gill", by original designation, equals Scyllium buergeri Müller & Henle, 1838.

Synonymy : "Pseudogenus" (= Subgenus) Gammascyllium Leigh-Sharpe, 1926 (Genus Scyllium Cuvier, 1817).

Field Marks : Scyliorhinids with short and rounded or pointed snouts, no nasoral grooves, anterior nasal flaps small and not reaching mouth, upper and lower labial furrows short, sometimes absent, inner margins of pelvic fins not connected, second dorsal not greatly smaller than first, caudal fin short, without enlarged denticles on dorsal margin, no supraorbital crests on cranium, colour pattern variably present or absent.

Diagnostic Features : Body not tadpole-shaped, slender to moderately stout and cylindrical or fusiform, tapering slightly or moderately to caudal fin; body firm and thick-skinned, with dermal denticles well-calcified or weakly so; stomach not inflatable; tail fairly short to rather long, length from vent to lower caudal origin about 2/5 of total length, to about equal to snout-vent length. Head moderately to considerably depressed, narrowly rounded to wedge-shaped in lateral view; head short to moderately long, between 1/4 and 1/5 to less than 1/5 of total length in adults; snout short to moderately long, less than 4/5 of mouth width, thick and slightly flattened, bluntly to narrowly pointed in lateral view; snout not expanded laterally, rounded, parabolic, pointed, or somewhat bell-shaped in dorsoventral view; ampullal pores not greatly enlarged on snout; nostrils of moderate size, with incurrent and excurrent apertures only partly open to exterior; anterior nasal flaps broadly triangular, narrow and elongated, or reduced and pointed, without barbels, well separate from each other and falling slightly to considerably anterior to mouth; internarial space about 0.6 to 1.1 times in nostril width; no nasoral grooves; eyes dorsolateral on head, broad subocular ridges present below eyes; mouth angular, semiangular, or rounded, short to moderately long, with lower symphysis well behind upper so that upper teeth are exposed in ventral view; labial furrows present along both upper and lower jaws, these short to very short and occasionally absent (H. buergeri), ending well behind level of upper symphysis of mouth when present; branchial region not greatly enlarged distance from spiracles to fifth gill slits 1/3 to slightly less than 3/5 of head length; gill slits lateral or dorsolateral on head. Two dorsal fins present, about equal-sized or with the second slightly smaller or larger than first; origin of first dorsal varying from slightly in front of the pelvic midbases to about over their insertions; origin of second dorsal varies from slightly in front of anal midbase to about over anal insertion; pectoral fins moderately large, their width subequal to or somewhat greater than mouth width; inner margins of pelvic fins not fused over claspers in adult males; claspers moderately long, fairly slender to moderately stout, and distally pointed, extending about half of their lengths behind the pelvic fin tips; anal fin moderately large but not greatly elongated, about as large as pelvic fins or slightly smaller or larger, subequal to or larger than the dorsals, its base length subequal to about twice the second dorsal base; origin of anal well behind pelvic bases, and insertion separated from lower caudal origin by a narrow to very broad space less than a fourth to over the length of the anal base; caudal fin short and broad to narrow and moderately elongated, between 1/4 and 1/5 to less than 1/5 of total length in adults; no crests of denticles on the caudal margins. Supraorbital crests absent from cranium. Colour light grey or brown to blackish without markings, or variably patterned with dark spots, saddles and vertical bars.

Remarks : This genus has been revised by Springer (1966, 1979) and Springer & D'Aubrey (1972); the present arrangement is adopted from their work with some modifications. These revisions removed species with supraorbital crests on their crania from Halaelurus: H. bivius and H. chilensis were included in the genus Schroederichthys, and H. labiosus in Aulohalaelurus. In addition, two Australian species without supraorbital crests, H. analis and H. vincenti, were separated from Halaelurus and from each other in the Whitleyian genera Asymbolus and Juncrus, but these genera are defined only on minor clasper and associated pelvic fin characters, and appear to be not separable from each other. Although these Australian taxa appear not to be closely related to typical Halaelurus (H. buergeri and allied species), the differences that distinguish them might be better expressed by ranking them together as a subgenus of Halaelurus. Even without these Australian species, Halaelurus remains a heterogeneous assemblage that may bear subdivision into at least two subgenera. Typical Halaelurus includes a presumably closely related cluster of similar Indo-West Pacific sharks, H. buergeri, H. boesemani, H. natalensis, H. lineatus, and H. quagga; all these species have rather flat, short heads with more or less pointed and sometimes upturned snouts, similar fin shapes and positions, firm skins, barred and spotted colour patterns, and dorsolateral gill slits; they appear to be closely related to the aberrant 'satellite genera' Holohalaelurus and Haploblepharus which share many of their features but are more specialized. It is uncertain if the remainder of Halaelurus species, unspotted, deepwater, often soft-skinned sharks with lateral gills form a coherant group or not; some of these, especially H. canescens, are rather Parmaturus-like. H. alcocki is a poorly known black, canescens-like shark that may or may not belong to this genus. A provisional account of this species is included below, but due to uncertainties on its distinguishing characters it is not included in the key to species.

Key to Species*:

1a. Snout more or less pointed and wedge-shaped. Gill slits elevated above level of mouth, dorsolateral in position. Body firm, skin thick with low, flat, smooth denticles. A variegated colour pattern of dark saddles, bars, and spots

  2a. Tip of snout definitely knoblike and upturned

    3a. Colour pattern of about 26 narrow dark bars, the darkest in pairs with a light bar in between and numerous small brown spots and vermiculate marks between the bars. Head rather narrow, mouth small and short, mouth width 7% of total length or less, length 2.6% of total length or less .... *H. lineatus*

    3b. Colour pattern of about 10 darker saddles consisting of dark bars surrounding a light centre, and with spots few or absent between the saddles. Head rather broad, mouth large and broad, mouth width 7.3 to 8.1% of total length, length 2.8 to 3.5% of total length .... *H. natalensis*

  2b. Tip of snout variably pointed but not upturned

    4a. Colour pattern of numerous vertical dark bars with few spots, with spots, where present, arranged in rows between bars .... *H. quagga*

    4b. Colour pattern of dark spots, with saddles or vertical bars obscure or absent

      5a. Dark spots few and mostly much larger than spiracles, sometimes in clusters around vague saddle blotches. Labial furrows reduced or absent, lowers 2 mm long or less .... *H. buergeri*

      5b. Dark spots small and very numerous, usually not much larger than spiracles, over or between weak saddles or bars .... *H. boesemani*

1b. Snout bluntly rounded. Gill slits not elevated above mouth level, lateral in position. Body soft, skin thin with erect denticles that gives it a velvety texture. No colour pattern or at most a line of white spots or blotches

  6a. Anal fin base as long as, or longer than interdorsal space

    7a. Anterior nasal flaps narrow-based and lobate. Sides of body with a line of white spots or white fin tips; caudal fin with dark bands .... *H. dawsoni*

    7b. Anterior nasal flaps triangular. Sides of body unspotted, fins plain .... *H. immaculatus*

  6b. Anal fin base shorter than interdorsal space

    8a. Anal fin base less than 1.3 times the second dorsal base. Colour dark brown or blackish above and below. Size greater, adults 44 cm and larger .... *H. canescens*

    8b. Anal fin base 1.5 times the second dorsal base or more. Colour grey or brown, sometimes with light saddle markings. Size smaller, adults 35 cm or less

      9a. Roof of mouth with numerous small papillae. Eye length less than 14 times in predorsal distance in adults. Adults 24 to 29 cm .... *H. hispidus*

      9b. Roof of mouth without papillae. Eye length 14 or more times in predorsal distance in adults. Adults 30 to 35 cm .... *H. lutarius*

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* Excluding *H. alcocki* (see remarks of that species, page 321)

Halaelurus alcocki Garman, 1913

SCYL Hal 1

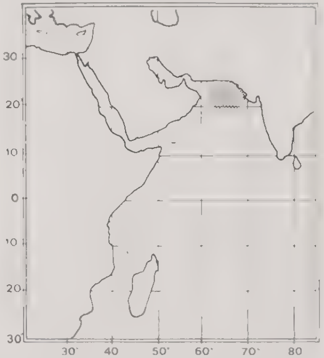
Halaelurus alcocki Garman, 1913, Mem.Mus.Comp.Zool.Harv.Coll., 36:87. Holotype: Indian Museum, Calcutta (Zoological Survey of India) 68/I. Type Locality: Arabian Sea, 1134 to 1262 m depth.

Synonymy : None.

FAO Names : En - Arabian catshark; Fr - Holbiche arabique; Sp - Pejegato arábigo.

Field Marks : See diagnostic features.

Diagnostic Features : Said to be similar to Halaelurus hispidus but differing in a longer snout, smaller eyes, larger labial furrows, cusplets on teeth about as long as median cusp, denticles slender and hooklike, without expanded crowns, second dorsal fin slightly larger than first, smaller anal fin, and black coloration with 'hoary grey surface' and white tips on some fins (Alcock, 1899).



Geographical Distribution : Northern Indian Ocean: Arabian Sea.

Habitat and Biology : A poorly known shark of the continental slope of the Arabian Sea, caught on or near the bottom in water 1134 to 1262 m deep.

Size : Unknown; the only known specimen was small, presumably less than 30 cm long.

Interest to Fisheries : None.

Literature : Alcock (1899); Garman (1913); Fowler (1941).

Remarks : Garman (1913) based this species on the Scyllium canescens of Alcock (1896, 1899), which he found to be not conspecific with Scyllium canescens Günther, 1878, from South America. While this is presumably correct, the available descriptive information on the species is so scanty that it is difficult to determine if the species is a member of this genus or some other deepwater scyliorhinid such as Apristurus. The holotype of the species, originally in the Indian Museum, Calcutta, may be lost. Springer (1979) listed it as a species dubium under Halaelurus, which is followed here.

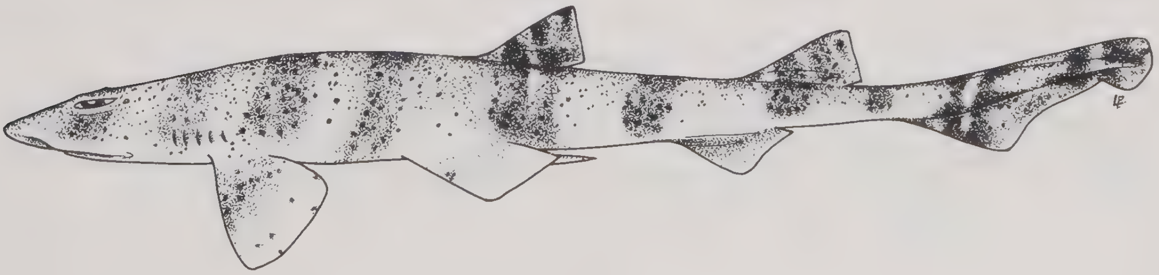
Halaelurus boesemani Springer & D'Aubrey, 1972

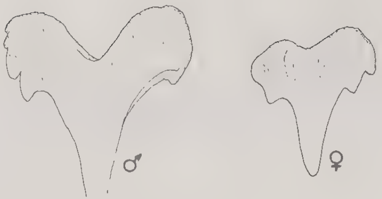
SCYL Hal 2

Halaelurus boesemani Springer & D'Aubrey, 1972, Invest.Rep.Oceanogr.Res.Inst., Durban, (29):11, figs 1D, 2, 3A. Holotype: U.S. National Museum of Natural History, USNM-205136, 430 mm adult male. Type Locality: 11°37'N, 51°27'E, off Somalia, from 67 to 72 m depth.

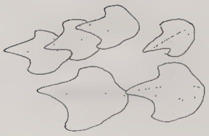
Synonymy : None.

FAO Names : En - Speckled catshark; Fr - Holbiche mouchetée; Sp - Pejegato pintado.





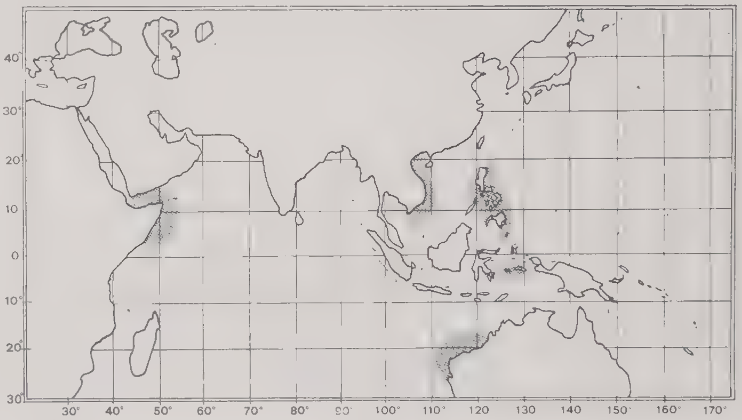
teeth



dermal denticles

Field Marks : A Halaelurus with pointed snout, elevated gill slits, colour pattern of few broad dark saddles, a dark marking on dorsal and caudal fins, and numerous small dark spots scattered on the body and fins.

Diagnostic Features : Snout tip pointed but not upturned and knoblike; eyes in adults less than 14 times in distance from snout to first dorsal origin; anterior nasal flaps subtriangular; labial furrows rather short, essentially confined to mouth corners, but lowers extending at least 5 mm onto lower jaw; mouth fairly narrow, its width 6 to 8% of total length, its length 3 to 4% of total length; status of papillae in pharynx unknown; gills directed dorsolaterally, elevated above level of mouth. First dorsal origin over last third of pelvic bases; second dorsal about as large as first, with origin over last third of anal base; abdomen short in adults, distance between pectoral and pelvic bases less than 1.5 times pectoral anterior margin; length of anal base about 1 to 1.3 times the second dorsal base, only 3/5 of distance between dorsal bases. Colour pattern prominent and variegated, with irregular dusky saddles on the back and caudal base, blotches on the dorsal and caudal fins, and numerous small black dots spread over the dorsal surface. Adults moderate-sized, to 46 cm.



Geographical Distribution : Indo-West Pacific: Somalia, Gulf of Aden, Western Australia, Amboina, the Philippines, Viet Nam.

Habitat and Biology : A little-known but wide-ranging bottom-dwelling shark of the continental and insular shelves, at depths of 37 to 91 m. Up to four egg capsules may occur in an oviduct, but it is uncertain if these hatch inside the oviduct or if the eggs are laid. Young may occur at advanced stages while eggs are still in the oviduct.

Size : Maximum 48 cm, adult males 42 to 48 cm, adults females 43 to 47 cm; size at hatching (or birth?) over 7 cm.

Interest to Fisheries : None at present.

Literature : Springer & D'Aubrey (1972); Springer (1979).

Remarks : This species was confused with H. buergeri until Springer & D'Aubrey (1972) found it to be a separate species.

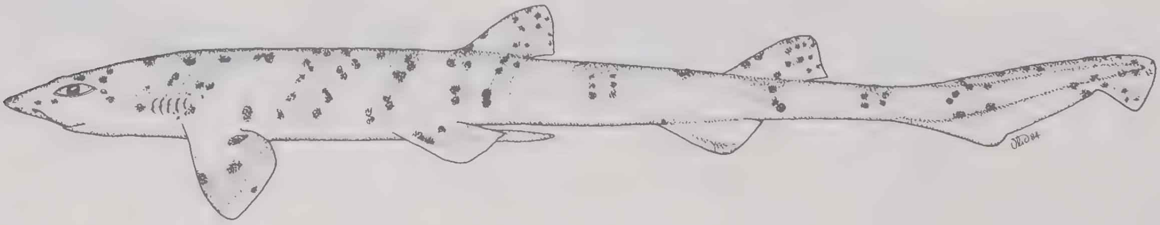
Halaelurus buergeri (Müller & Henle, 1838)

SCYL Hal 3

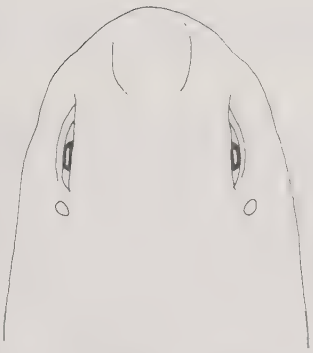
Scyllium buergeri Müller & Henle, 1838, Syst.Beschr.Plagiost., (pt.1):8. Lectotype: Rijksmuseum van Natuurlijke Historie, Leiden, RMNH D2593. Type Locality: Japan.

Synonymy : None.

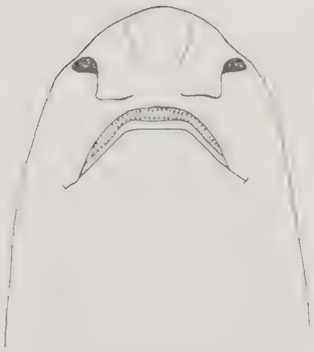
FAO Names : En - Blackspotted catshark; Fr - Holbiche à taches noires; Sp - Pejegato de manchas negras.



Field Marks: A Halaelurus with pointed snout, short abdomen, short anal base, and colour pattern of dusky bands flanked by large black spots.



dorsal view of head



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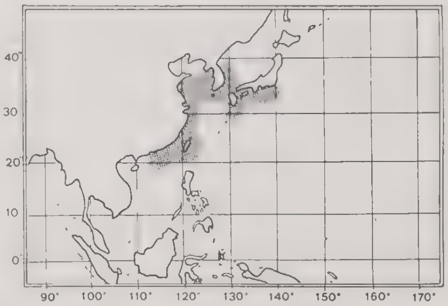
Diagnostic Features: Snout tip not upturned and knoblike, pointed; eyes in adults less than 14 times in distance from snout to first dorsal origin; anterior nasal flaps subtriangular; labial furrows extremely short or absent, when present essentially confined to mouth corners and with lowers extending 2 mm or less onto lower jaw; mouth moderate-sized, its width 7% of total length, its length 3 to 4% of total length; status of papillae in pharynx unknown; gill slits directed dorsolaterally, elevated above level of mouth. First dorsal origin over last fourth of pelvic bases; second dorsal about as large as or slightly smaller than first, its origin over last third of anal base; abdomen short in adults, distance between pectoral and pelvic bases less than 1.5 times pectoral anterior margin; length of anal base about 1.3 times the second dorsal base, almost 2 times in distance between dorsal bases. Colour pattern variegated, with obscure dusky saddles and large black spots outlining their margins on a light background. Adults moderate-sized, to about 49 cm.

Geographical Distribution: Western North Pacific: Japan, the Koreas, China, including Taiwan Island.



Habitat and Biology: A little-known, but common tropical and temperate bottom-dwelling catshark of the western Pacific continental shelf, at depths down from 80 to 100 m. Oviparous, but with several egg-capsules retained in the oviduct until embryos reach an advanced stage before they are laid, which is a condition regarded by Nakaya (1975) as being intermediate between oviparity with one egg being laid per uterus at a time, with the embryo at an early stage, and ovoviviparity.

Size: Maximum about 49 cm, adolescent male 36 cm, adult males from 36 to 43 cm, female immature at 36 cm and gravid at 45 cm.

Interest to Fisheries: None at present, taken with bottom trawls in the Taiwan Straits.

Literature: Fowler (1941); Springer & D'Aubrey (1972); Nakaya (1975); Springer (1979).

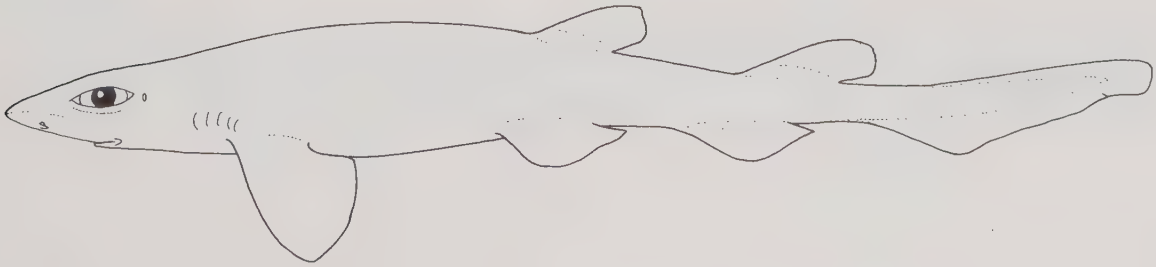
Halaelurus canescens (Günther, 1878)

SCYL Hal 4

Scyllium canescens Günther, 1878, Ann.Mag.Nat.Hist., ser. 5, 2(8):18. Holotype: British Museum (Natural History). Type Locality: "South-west coast of South America".

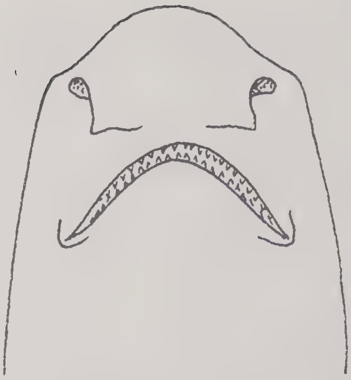
Synonymy: None.

FAO Names: En - Dusky catshark; Fr - Holbiche sombre; Sp - Pejegato oscuro.



Field Marks: A Halaelurus with rounded snout, long abdomen, short anal base, about 1.3 times the first dorsal base, usually plain dark brown coloration, and large size.

Diagnostic Features: Snout tip not upturned and knoblike, bluntly rounded; eyes in adults 9 to 12 times in distance from snout to first dorsal origin; anterior nasal flaps subtriangular; labial furrows rather short, essentially confined to mouth corners, but lowers extending at least 5 mm onto lower jaw; mouth large, its width 8 to 10% of total length, its length 4 to 5% of total length; oral papillae probably present in pharynx unknown; gills directed laterad, not elevated above level of mouth. First dorsal origin over first third of pelvic bases; second dorsal slightly larger than first, its origin anterior to anal midbase; abdomen moderately elongated in adults, distance between pectoral and pelvic bases 1.2 to 1.5 times the pectoral anterior margin; length of anal base about 1.3 times the second dorsal base, slightly shorter than distance between dorsal bases. Colour dark chocolate brown, without markings except for white fin tips in young. Adults moderately large, 45 to 66 cm long.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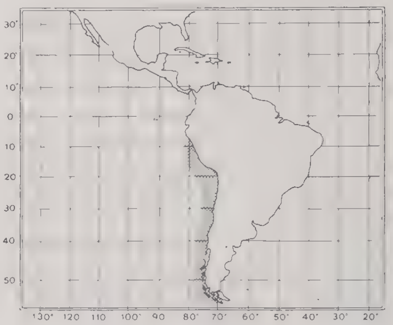
Geographical Distribution: Eastern South Pacific: Peru, Chile, Straits of Magellan.



Habitat and Biology: A common temperate deepwater catshark of the upper continental slopes of South America, primarily on mud, but also on rock bottoms at 250 to 700 m depth. Oviparous, apparently laying a single egg per oviduct at a time. Feeds on bottom invertebrates.

Size: Maximum 70 cm, adult males 59 to 65 cm, adult females 59 to 66 cm.

Interest to Fisheries: None at present, abundant in deepwater trawl hauls.

Literature: Kato, Springer & Wagner (1967); Springer & D'Aubrey (1972); Springer (1979).

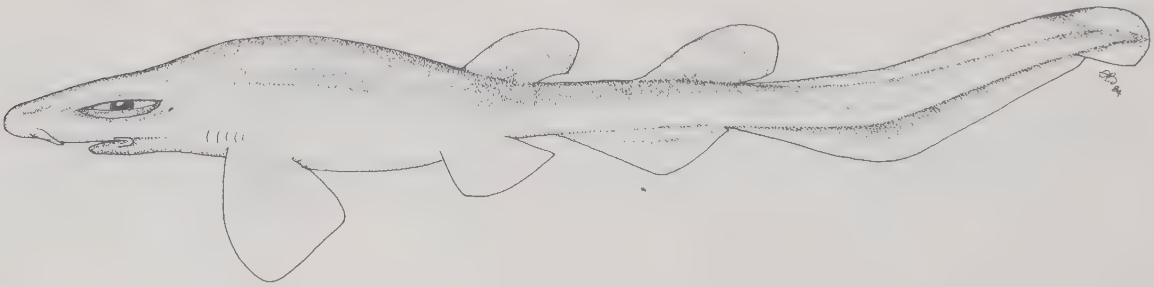
Halaelurus dawsoni Springer, 1971

SCYL Hal 5

Halaelurus dawsoni Springer, 1971, Rec.Dom.Mus.Wellington, 7(18):235-41, fig. 1. Holotype: National Museum of New Zealand (formerly Dominion Museum), DM (or NMNZ) 5188.1, 349 mm subadult male. Type Locality: West of southern South Island, New Zealand, 44°32.5'S, 166°41'E, 389 to 420 m depth.

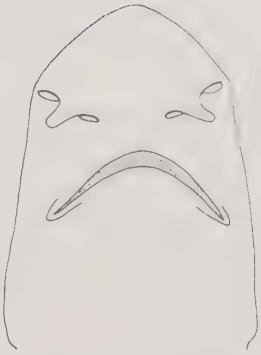
Synonymy: None.

FAO Names: En - New Zealand catshark; Fr - Holbiche kiwi; Sp - Pejegato neozelandés.



Field Marks : A Halaelurus with rounded snout, elongated lobate anterior nasal flaps, moderately long abdomen, moderately long anal base, light coloration with white spots.

Diagnostic Features : Snout tip not upturned and knoblike, thick and bluntly rounded; eyes 9 to 11 times in distance from snout to first dorsal origin. Anterior nasal flaps narrowly lobate and elongate; labial furrows moderately long, lowers extending at least 5 mm onto lower jaw; mouth moderately large, its width 8% of total length, its length about 3% of total length; papillae present in pharynx; gills directed laterad, not elevated above level of mouth. First dorsal origin over first fourth of pelvic bases; second dorsal considerably larger than first, its origin anterior to anal midbase; abdomen moderately short, distance between pectoral and pelvic bases 1.1 to 1.4 times the pectoral anterior margin; length of anal base about 1.3 to 1.5 times the second dorsal base, considerably longer than distance between dorsal bases. Colour light brown or grey above, whitish below, white spots on sides of small specimens.



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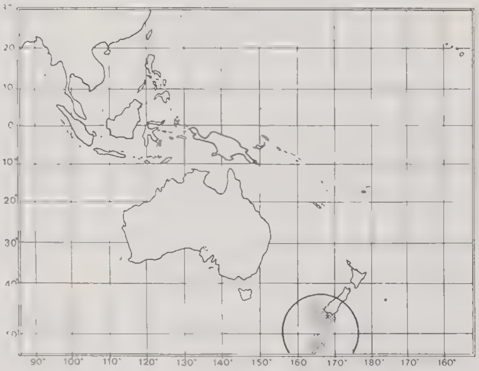
Geographical Distribution : Western South Pacific: New Zealand, Auckland Island.



Habitat and Biology : A little-known but common deepwater temperate catshark of the upper insular slopes, on or near the bottom from 371 to 420 m. Development mode uncertain. Feeds on bottom crustaceans, including shrimp, crabs, euphausiid shrimp, and amphipods.

Size : Largest known specimen 34.9 cm (subadult male holotype), estimated size at maturity 35 to 45 cm total length.

Interest to Fisheries : None.

Literature : Springer (1971, 1979).

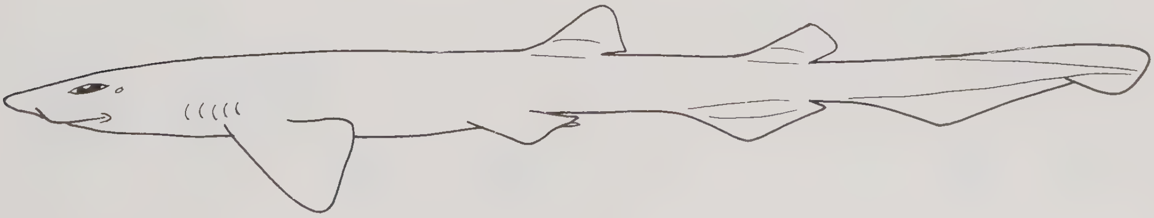
Halaelurus hispidus (Alcock, 1891)

SCYL Hal 6

Scyllium hispidum Alcock, 1891, Ann.Mag.Nat.Hist.(Ser. 6), 8:21. Holotype: Zoological Survey of India, ZSI-13120, 220 mm adolescent or immature male. Type Locality: Andaman Sea, 344 to 402 m depth.

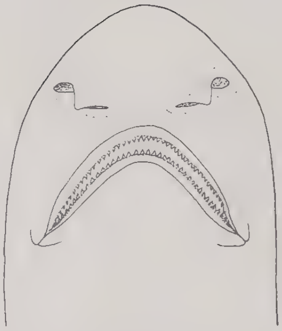
Synonymy : None.

FAO Names : En - Bristly catshark; Fr - Holbiche mignonne; Sp - Pejegato erizado.



Field Marks : A Halaelurus with rounded snout, long abdomen, short anal base, plain light coloration, large size (see diagnostic features and remarks, below).

Diagnostic Features : Snout tip not upturned and knoblike, broadly parabolic; eyes in adults less than 14 times in distance from snout to first dorsal origin; anterior nasal flaps subtriangular; labial furrows rather short, essentially confined to mouth corners, but lowers extending at least 5 mm onto lower jaw; mouth moderately large, its width 8 to 10% of total length, its length 4 to 5% of total length; papillae present in pharynx; gills directed laterad, not elevated above level of mouth. First dorsal origin over last third of pelvic bases; second dorsal slightly smaller than first, its origin over or slightly in front of anal midbase; abdomen moderately long in adults, distance between pectoral and pelvic bases 1.3 to 1.4 times the pectoral anterior margin; length of anal base about 1.5 to 1.7 times the second dorsal base, slightly shorter than distance between dorsal bases. Colour pale brown or whitish, sometimes with obscure grey crossbands, white spots, or dusky spots. Adults very small, 29 cm or less.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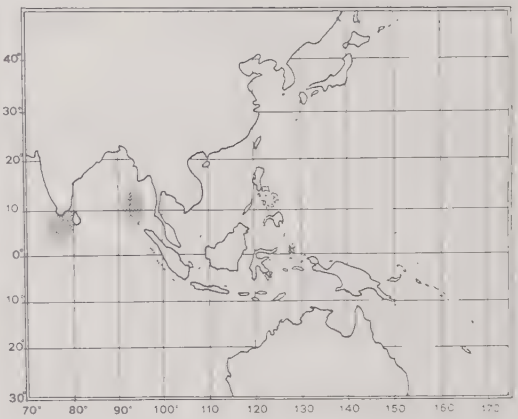
Geographical Distribution : Indian Ocean: Southeastern India, Andaman Islands.

Habitat and Biology : A common deepwater bottom-dwelling catshark of the upper continental slopes at depths of 293 to 766 m. Mode of development uncertain. Eats small fishes, squid and crustacea.

Size : Maximum 29 cm, adult males 24 to 26 cm, adult females about 22 to 29 cm.

Interest to Fisheries : None at present.

Literature : Nair & Lal Mohan (1973); Nair & Appucuttan (1973, 1974).



Remarks : The holotype of this species is in the Zoological Survey of India in Calcutta, and is not the 237 mm specimen in the British Museum (Natural History) stated to be the holotype by Springer (1979), according to P.K. Talwar (pers.comm.). The writer examined the holotype of this species in the Zoological Survey of India collection upon which the illustration is based.

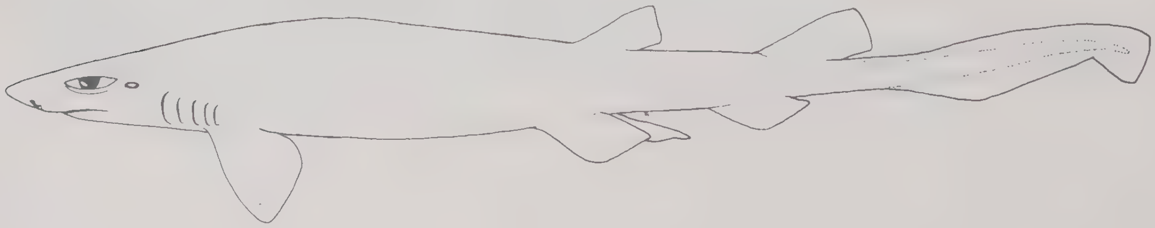
Halaelurus immaculatus, Chu & Meng, 1982

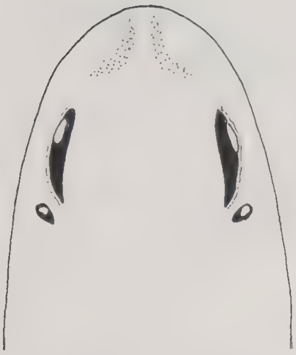
SCYL Hal 7

Halaelurus immaculatus Chu & Meng, in Chu et al., 1982, Oceanol.Limnol.Sinica, 13(4):301, fig. 1. Holotype: South China Seas Fisheries Research Institute No. 00094, 708 mm adult male. Type Locality: South China Sea at 19°39.6'N, 114°23.6'E, about 400 km east of Hainan Island; depth 1020 m.

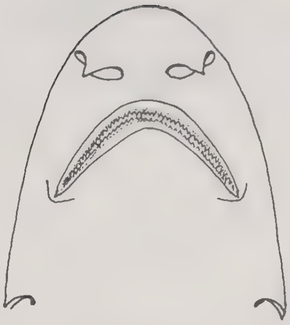
Synonymy : None (but see remarks below).

FAO Names : En - Spotless catshark; Fr - Holbiche glabre; Sp - Pejegato immaculado.





dorsal view of head



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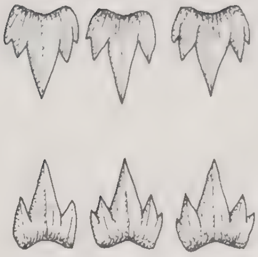
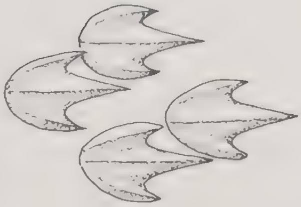


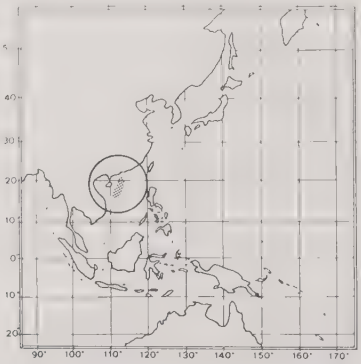
upper and lower teeth



dermal denticles

Field Marks: A Halaelurus with rounded snout, long abdomen, short anal base, plain light coloration, large size (see diagnostic features and remarks, below).

Diagnostic Features: Snout tip not upturned and knoblike; eyes in adults less than 11 times in distance from snout to first dorsal origin; anterior nasal flaps subtriangular; labial furrows rather short, essentially confined to mouth corners, but lowers extending at least 5 mm onto lower jaw; mouth moderately large, its width 9% of total length, its length 5% of total length; status of papillae in pharynx unknown; gills directed ventrad, not elevated above level of mouth. Origin of first dorsal about over pelvic midbases; second drosal considerably larger than first, its origin about over anal midbase; abdomen elongated in adults, distance between pectoral and pelvic bases over 2.5 times the pectoral anterior margin; length of anal base about 1.3 times the second dorsal base, slightly longer than distance between dorsal bases. Colour drab yellowish-brown, without markings. Adults moderately large, 71 to 76 cm.



Geographical Distribution: Western North Pacific: Only known from the South China Sea at about 380 to 400 km east of Hainan Island.

Habitat and Biology: A recently described benthic catshark of the western Pacific continental slope, at depths of 534 to 1020 m.

Size: Maximum 76 cm; two females, presumably adult, 75 to 76 cm; adult male 71 cm.

Interest to Fisheries: None at present.

Literature: Chu et al. (1982).

Remarks: Generic placement and recognition of this species is provisional and is based on Chu et al. (1982). The species is close to and possibly a synonym of the New Zealand Halaelurus dawsoni but differs in possibly having less lobate nasal flaps, shorter labial furrows, a longer abdomen, and possibly greater size. No material of this shark was available for examination, nor could the writer examined adult specimens of H. dawsoni.

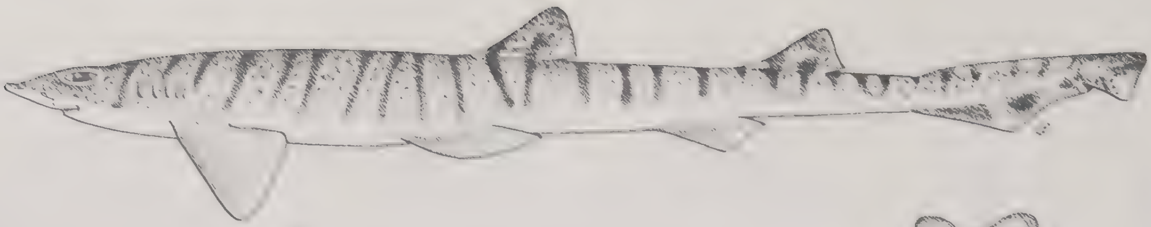
Halaelurus lineatus Bass, D'Aubrey & Kistnasamy, 1975

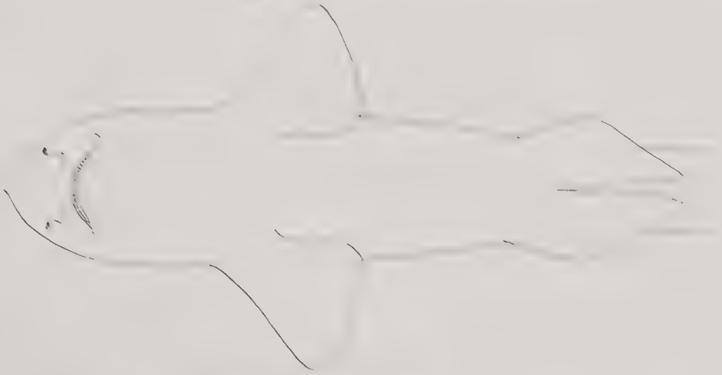
SCYL Hal 8

Halaelurus lineatus, Bass, D'Aubrey & Kistnasamy, 1975, Invest.Rep.Oceanogr.Res.Inst., Durban, (37):12, figs 8, 20E. Holotype: Oceanographic Research Institute, Durban, South Africa, ORI 2935, now J.L.B. Smith Institute of Ichthyology, RUSI 6148, 500 mm adult female. Type Locality: Close inshore off Durban, South Africa (collected from shore with rod and reel).

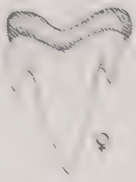
Synonymy: None.

FAO Names: En - Lined catshark; Fr - Holbiche des plages; Sp - Pejegato playero.

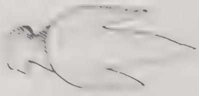




partial ventral view



tooth

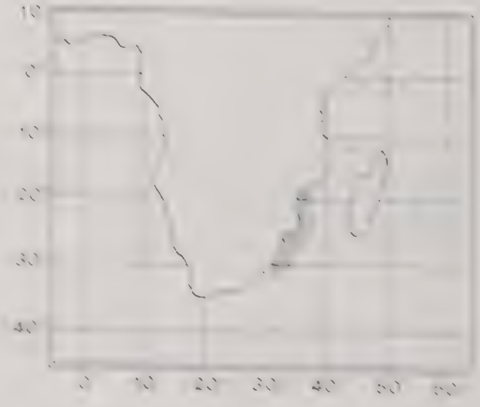


dermal denticle

Field Marks : A catshark with upturned knob on snout, narrow head, and barred and spotted coloration.

Diagnostic Features : Snout tip pointed, upturned and knoblike; eyes in adults 11 to 15 times in distance from snout to first dorsal origin; anterior nasal flaps subtriangular; labial furrows rather short, essentially confined to mouth corners, but lowers extending at least 5 mm onto lower jaw; mouth fairly small, its width 6 to 7% of total length, its length about 2% of total length; papillae absent from much of pharynx except around jaws; gills directed dorsolaterad, elevated above level of mouth. Origin of first dorsal about over midbases of pelvic fins; second dorsal considerably larger than first, its origin over rear fourth or insertion of anal base; abdomen moderately short in adults, distance between pectoral and pelvic bases 1.1 to 1.4 times pectoral anterior margin; length of anal base about 0.9 to 1.5 times second dorsal base, much longer than distance between dorsal bases. Colour pale brown above, cream below, with about 26 bold vertical dark brown and narrow stripes, arranged in pairs and outlining obscure dusky saddles, with numerous small spots and vermiculate marks between saddles. Adults moderately large, to at least 56 cm.

Geographical Distribution : Western Indian Ocean: South Africa and Mozambique.



Habitat and Biology : A common warm-temperate to tropical catshark of the southern African continental shelf, from close inshore at the surf line to 290 m depth. Very few adult males and young of either sex have been taken off Natal, with most individuals caught there being gravid females, which may indicate strong geographic or bathymetric segregation.

Possibly oviparous, but with up to 8 egg-cases per oviduct, which are retained there until embryos are at an advanced stage of development. Eggs laid and kept in aquaria hatched in 23 to 36 days (in water with a temperature of 19 to 20°C). Gravid females commonly occur in the surf in Natal during late winter, but egg-cases have not been found, leading one to suspect that normally egg-cases are retained in the oviducts until young hatch, and that eggs laid in aquaria may be premature. These sharks are readily kept in aquaria.

Feeds mostly on crustaceans, but also on bony fishes and cephalopods; in captivity it prefers crustacean meat to that of fishes or squid.

Size : Maximum about 56 cm, adult males 48 to 56 cm, adult females 46 to 52 cm.

Interest to Fisheries : None at present, caught in the surf in Natal by sports anglers with rod and reel.

Literature : Springer & D'Aubrey (1972); Bass, D'Aubrey & Kistnasamy (1975a); Springer (1979).

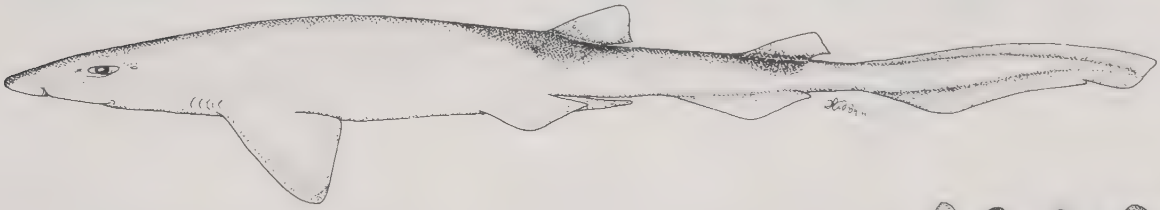
Halaelurus lutarius Springer & D'Aubrey, 1972

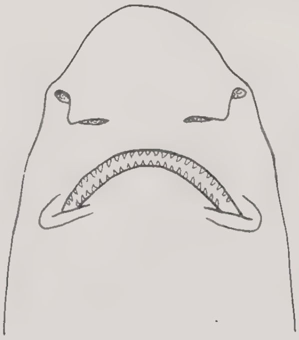
SCYL Hal 9

Halaelurus lutarius Springer & D'Aubray, 1972, Invest.Rep.Oceanogr.Res.Inst., Durban, (29):6, figs 1A, 2. Holotype: U.S. National Museum of Natural History, USNM-205135, 326 mm adult male. Type Locality: Off Delagoa Bay, Mozambique, 25°32'S, 33°24'E, 450 to 455 m depth.

Synonymy : None.

FAO Names : En - Mud catshark; Fr - Holbiche des vases; Sp - Pejegato fanguero.





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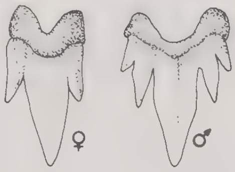
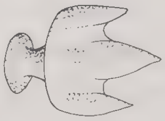


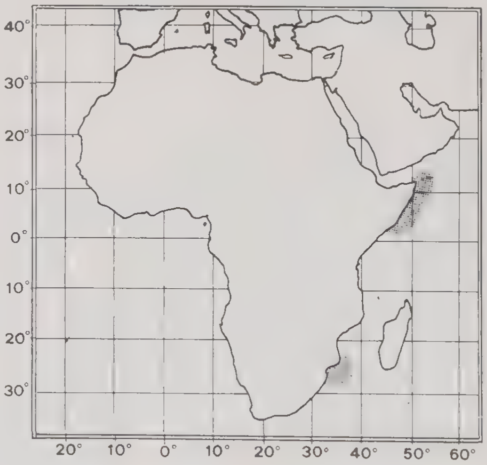
teeth



ermal denticle

Field Marks : A Halaelurus with rounded snout, moderate-sized abdomen, fairly long anal base, plain light coloration, large size (see diagnostic features and remarks below).

Diagnostic Features : Snout tip not upturned and knoblike, narrowly rounded; eyes in adults 14 or more times in distance from snout to first dorsal origin; anterior nasal flaps subtriangular; labial furrows rather short, essentially confined to mouth corners, but lowers extending at least 5 mm onto lower jaw; mouth moderately large, its width 6 to 8% of total length, its length 4% of total length; papillae absent from pharynx; gills directed laterad, not elevated above level of mouth. Origin of first dorsal fin over or slightly in front of pelvic insertions; second dorsal somewhat smaller than first, its origin about over anal midbase; abdomen moderately long in adults, distance between pectoral and pelvic bases 1.3 to 1.6 times pectoral anterior margin; length of anal base about 1.5 times the second dorsal base, slightly shorter than distance between dorsal bases. Colour grey-brown above and light below, sometimes with obscure saddle bands. Adults small, to about 37 cm.



Geographical Distribution : Western Indian Ocean: Mozambique and Somalia.

Habitat and Biology : A deepwater tropical catshark of the continental slope of the western Indian Ocean, on or just above muddy bottom, at 338 to 766 m depth. Apparently ovoviviparous, as egg-cases are thin-walled, extremely fragile baglike structures unlike the stout egg-cases of typical oviparous species, and would be of little protection to developing young. Eats cephalopods, small bony fishes, and crustaceans.

Size : Maximum 39 cm, adult males 31 to 34 cm, and adult females 31 to 39 cm. Size at birth about 10 cm.

Interest to Fisheries : None at present.

Literature : Springer & D'Aubrey (1972); Bass, D'Aubrey & Kistnasamy (1975a); Springer (1979).

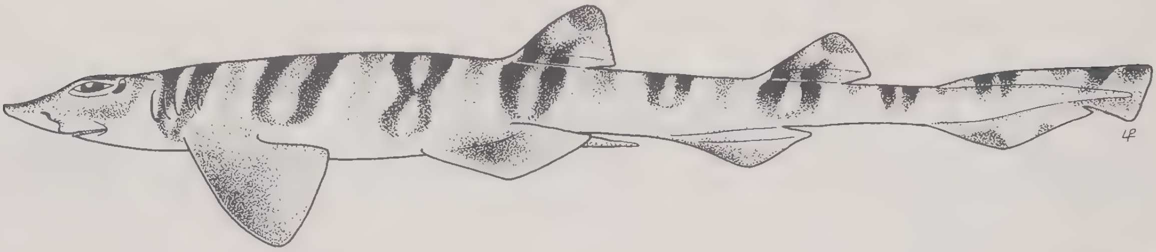
Halaelurus natalensis (Regan, 1904)

SCYL Hal 10

Scyllium natalense Regan, 1904, Ann.Mag.Nat.Hist.(Ser. 7), 14(80):128. Holotype: In British Museum (Natural History), 2 syntypes?. Type Locality: Natal, South Africa.

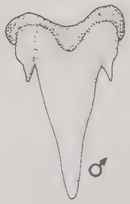
Synonymy : None.

FAO Names : En - Tiger catshark; Fr - Holbiche tigrée; Sp - Pejegato atigrado.

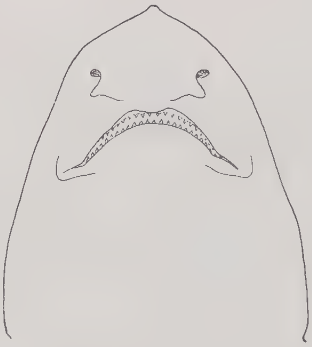


Field Marks : A catshark with pointed, upturned snout tip, broad head, coloration of broad bars and no spots.

Diagnostic Features : Snout tip pointed, upturned and knoblike; eyes in adults 11 to 14 times in distance from snout to first dorsal origin; anterior nasal flaps subtriangular or semilobate; labial furrows rather short, essentially confined to mouth corners, but lowers extending at least 5 mm onto lower jaw; mouth moderately large, its width 7 to 9% of total length; its length 2 to 3% of total length; papillae present in pharynx; gills directed dorsolaterally, elevated above level of mouth. Origin of first dorsal over last third of pelvic bases; second dorsal considerably larger than first, its origin about over anal insertion; length of anal base about 1.3 times the second dorsal base, slightly longer than distance between dorsal bases. Colour yellow-brown above, cream below, with 10 pairs of broad dark brown bars enclosing lighter areas, without spots or vermiculated markings between them. Adults to 47 cm.



tooth



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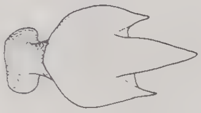
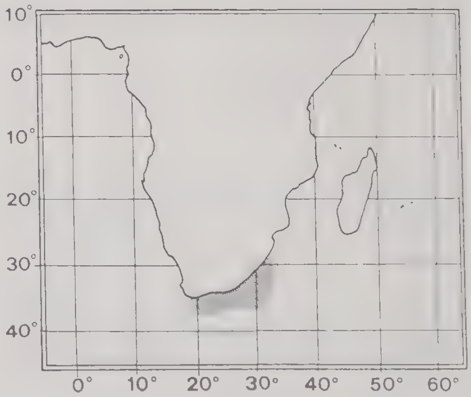


dermal denticle

Geographical Distribution : Western Indian Ocean: South Africa (Cape and Natal coasts) and Mozambique.



Habitat and Biology : An inshore to offshore temperate catshark of the southern African continental shelf, found on or near the bottom, from close inshore to possibly 172 m depth. Individuals caught offshore in trawls are mostly adult.

Oviparous, can have 6 to 11 egg-cases per oviduct (more usually 6 to 9) at a time. Each egg-case is about 4 by 1.5 cm long, with strong, thick tendrils to attach them to the substrate. Although the eggs are eventually laid, they are apparently retained inside the oviducts until the embryos inside them are fairly advanced (at least 43 mm long), which lowers their hatching time and exposure to egg-predators.

Feeds primarily on small bony fishes and crustaceans, but also cephalopods and small elasmobranchs.

Size : Maximum 47 cm, adult males 42 to 45 cm, adult females 47 cm.

Interest to Fisheries : None at present, commonly taken by bottom trawlers and also taken by sports anglers with rod and reel.

Literature : Fowler (1941); Springer & D'Aubrey (1972); Bass, D'Aubrey & Kistnasamy (1975a); Springer (1979).

Remarks : Until recently two species were confused under this name, the present one and the recently described H. lineatus. Hence there are few dependable depth records for H. natalensis.

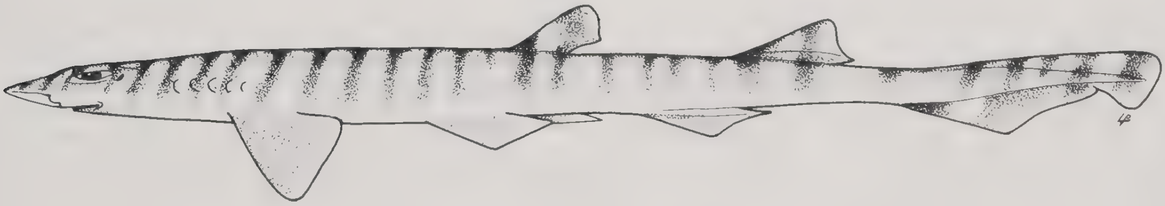
Halaelurus quagga (Alcock, 1899)

SCYL Hal 11

Scyllium quagga Alcock, 1899, Descr.Cat.Indian deep-sea fish., Indian Mus., Calcutta, 1:17. Holotype: Zoological Survey of India, ZSI F751/1, 273 mm adult male. Type Locality: Laccadive Sea, India, 187 m.

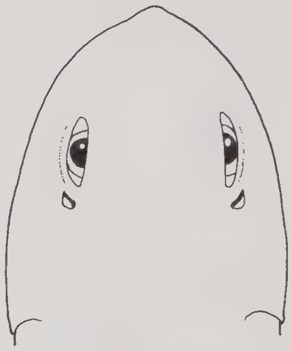
Synonymy : None.

FAO Names : En - Quagga catshark; Fr - Holbiche quagga; Sp - Pejegato quagga.



Field Marks : A Halaelurus with pointed but not upturned snout, short abdomen, and bold vertically striped zebra colour pattern.

Diagnostic Features : Snout tip pointed, but not strongly upturned and knoblike; eyes in adults 12 to 13 times in distance from snout to first dorsal origin; anterior nasal flaps subtriangular; labial furrows rather short, essentially confined to mouth corners, but lowers extending at least 5 mm onto lower jaw; mouth moderately large, its width 6 to 9% of total length, its length 4% of total length; papillae absent from pharynx?; gills directed dorsolaterad, elevated above level of mouth. First dorsal origin about opposite pelvic insertions; second dorsal somewhat larger than first, with origin about opposite or slightly behind anal insertion; abdomen short in adults, distance between pectoral and pelvic bases 1.2 times pectoral anterior margin; length of anal base about 1.1 to 1.3 times the second dorsal base, considerably shorter than distance between dorsal bases. Colour light brown above, lighter below, with over 20 dark brown narrow vertical bars, with pairs forming saddles under dorsal fins but otherwise single, no spots between bars. Adults small, 35 cm or less.



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Geographical Distribution : Indian Ocean: Somalia, India.

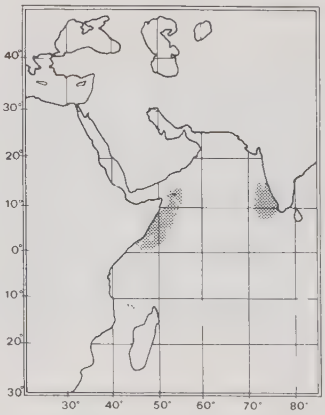
Habitat and Biology : A little-known tropical offshore catshark of the continental shelves of the northwestern Indian Ocean, found on or near the bottom at 54 to 186 m depth.

Size : Maximum about 35 cm, adult males 28 to 35 cm, size at hatching (or birth?) about 8 cm.

Interest to Fisheries : None at present.

Literature : Fowler (1941); Springer & D'Aubrey (1972); Springer (1979).

Remarks : The writer examined the holotype of this species in the Zoological Survey of India, Calcutta, from which the illustration is derived. This has a pointed, knoblike but not prominently upturned snout-tip. There are some differences in colour pattern between the holotype, from southwestern India, and the Somalian material described by Springer & D'Aubrey (1972) and Springer (1979).



Haploblepharus Garman, 1913

SCYL Hap

Genus : Haploblepharus Garman, 1913, Mem.Mus.Comp.Zool.Harv.Coll., 36:501.

Type Species : Haploblepharus edwardsii Garman, 1913, by monotypy, equals Scyllium edwardsii Voigt, in Cuvier, 1832.

Synonymy : None.

Field Marks : Stocky broad-headed scyliorhinids with greatly expanded anterior nasal flaps that reach mouth, nasoral grooves, dorsolateral gill slits, and anal fin about as large as equal sized dorsals.

Diagnostic Features : Body not tadpole-shaped, fairly stout and spindle shaped, tapering slightly to caudal fin; body firm and thick-skinned, with well-calcified dermal denticles; stomach not inflatable; tail moderately long, length from vent to lower caudal origin about 4/5 of snout-vent length. Head depressed, narrowly rounded in lateral view and not wedge-shaped; head short, less than 1/5 of total length in adults; snout short, less than 2/3 of mouth width, thick, slightly flattened, and bluntly pointed in lateral view; snout not expanded laterally, broadly rounded but not bell-shaped in dorsoventral view; ampullal pores not greatly enlarged on snout; nostrils very large, with incurrent apertures only partly open to exterior; anterior nasal flaps very broadly triangular, without barbels, nearly meeting at the midline of the snout and overlapping mouth; internarial space less than 0.5 times in nostril width; broad nasoral grooves present, connecting excurrent apertures with mouth and covered by expanded anterior nasal flaps; eyes dorsolateral on head, broad subocular ridges present below eyes; mouth short and broadly rounded, with lower symphysis covering upper so that upper teeth are not visible in ventral view; labial furrows present along both upper and lower jaws, these moderately long but ending somewhat behind level of upper symphysis of mouth; branchial region not greatly enlarged distance from spiracles to fifth gill slits about 2/5 of head length; gill slits dorsolateral on head. Two dorsal fins present, about equal-sized, origin of first varying from over last third of pelvic bases to about over their insertions; origin of second dorsal over or slightly behind the anal midbase; pectoral fins moderately large, their width subequal or somewhat greater than mouth width; inner margins of pelvic fins not fused over claspers in adult males; claspers moderately long, fairly thick, and distally pointed, extending about half of their lengths behind the pelvic fin tips; anal fin moderately large but not greatly elongate, about as large as dorsal and pelvic fins, its base length subequal to about 1.3 times second dorsal base; origin of anal well behind pelvic bases, and insertion separated from lower caudal origin by a broad space subequal to the anal base; caudal fin fairly short and broad, about a fifth of total length in adults. No crests of denticles on the caudal margins; supraorbital crests absent from cranium. Colour golden brown without a conspicuous colour pattern, or marked with dark blotches, saddles, and white spots.

Remarks : This genus was reviewed by Bass, D'Aubrey & Kistanasamy (1975a) and Springer (1979).

Key to Species :

1a. Colour uniform golden brown .... **H. fuscus**

1b. Variegated colour pattern present

    2a. First dorsal origin over or behind pelvic insertions. Dorsal saddle markings with conspicuous darker margins; saddles dotted with numerous small white spots.................. **H. edwardsii**

    2b. First dorsal origin somewhat ahead of pelvic insertions. Dorsal saddle markings without conspicuous darker margins; saddles dotted with sparse large white spots .... **H. pictus**

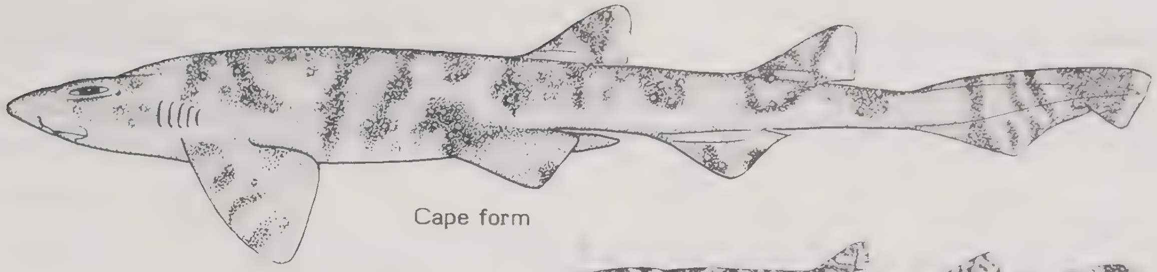
Haploblepharus edwardsii (Voigt, 1832)

SCYL Hap 1

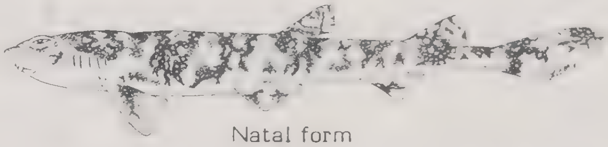
Scyllium edwardsii Voigt, in Cuvier, 1832, Tierreich, 2:504. Holotype: ?. Type Locality: South Africa.

Synonymy : None.

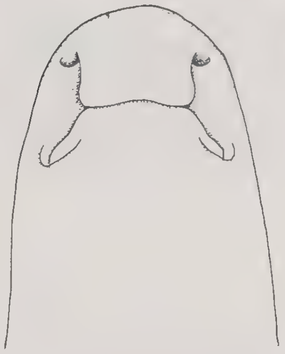
FAO Names : En - Puffadder shyshark; Fr - Roussette vipérine; Sp - Alitán viperino.



Cape form



Natal form



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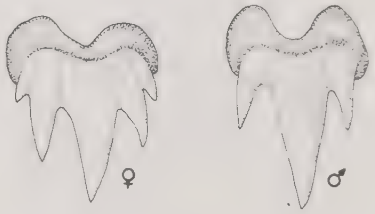
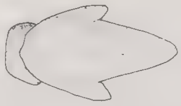


teeth

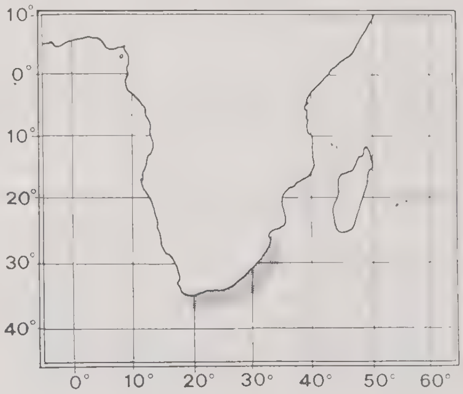


dermal denticle

Field Marks : Broad-headed, stout-bodied catsharks with greatly expanded anterior nasal flaps that reach mouth and cover, broad nasoral grooves, dorsolateral gill slits, variegated colour pattern with dark-margined dorsal saddles, dotted with small white spots.

Diagnostic Features : First dorsal origin over or behind pelvic insertions. Colour pattern with striking dorsal saddles, bordered with conspicuous darker margins; saddles dotted with numerous light spots, mostly smaller or equal in size to spiracles.

Geographical Distribution : Western Indian Ocean: South Africa (Western Cape Province to Natal).



Habitat and Biology : A common shark of inshore and offshore temperate waters of the continental shelf, on or near the bottom, from the surfline to 130 m depth; commonly on sandy and rocky bottoms. The 'Cape' form of this species shows progressive submergence around the Cape from close inshore down to 15 m in the west to 40 to 130 m in the east.

Oviparous, with a single egg-case laid per oviduct. Size of egg-cases about 3.5 to 5 cm long and 1.5 to 3 cm wide.

Eats small bony fishes, crustaceans and cephalopods in about equal quantities.

Size : Maximum 60 cm, males maturing between 42 and 51 cm and reaching 59 cm as adults; females maturing at about 41 cm or more and reaching 60 cm as adults; individuals from southwestern Cape Province may mature at a smaller size than those from northern Natal. Size at hatching about 10 cm.

Interest to Fisheries : Limited, caught by surf anglers with rod and reel and by bottom trawlers, but apparently little-utilized.

Literature : Bass, D'Aubrey & Kistnasamy (1975); Springer (1979).

Remarks : Bass, D'Aubrey & Kistnasamy (1975) cited "Scyllium D'Edwards Cuvier, 1817" as the earliest name for this species, but reference to Cuvier (1817, also 1829) suggests that he did not propose a scientific name, but rather a vernacular ("sq. d'Edwards"). Bass, D'Aubrey & Kistnasamy note that there are two different forms of this species, the "Cape" and "Natal" types, that might be geographic variants or two species. These differ in coloration and in habitat, the "Cape" type occurring in deeper cold water in the northeast part of its range, but further northeast the "Natal" type occurs close inshore in warm water at the surfline to 30 m.

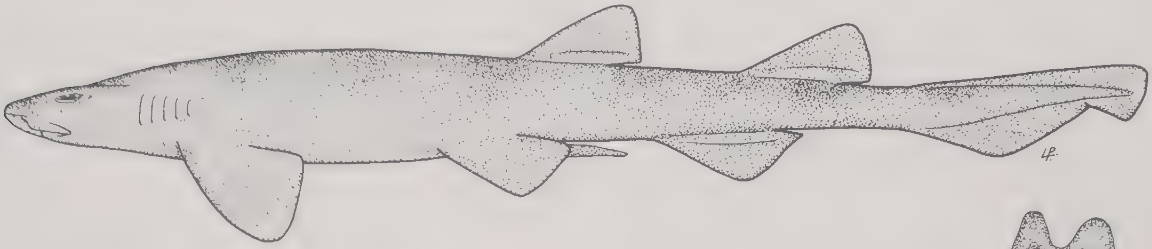
Haploblepharus fuscus Smith, 1950

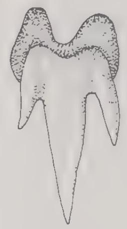
SCYL Hap 2

Haploblepharus fuscus Smith, 1950, *Ann.Mag.Nat.Hist.(Ser. 12)*, 3:883, fig. 2. Holotype: J.L.B. Smith Institute of Ichthyology, Rhodes University, RUSI 21, 570 mm adult male. Type Locality: East London, South Africa.

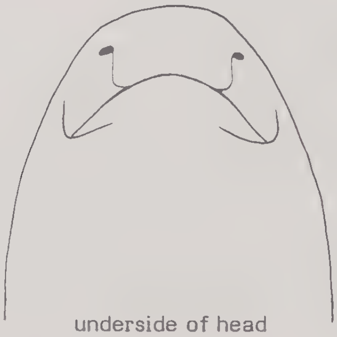
Synonymy : None.

FAO Names : En - Brown shyshark; Fr - Roussette brune; Sp - Alitán marrón.





tooth



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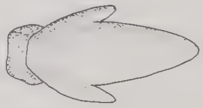
Field Marks : A broad-banded, stout-bodied catshark with greatly expanded anterior nasal flaps that reach mouth and cover broad nasoral grooves, dorsolateral gill slits, colour uniform brown.

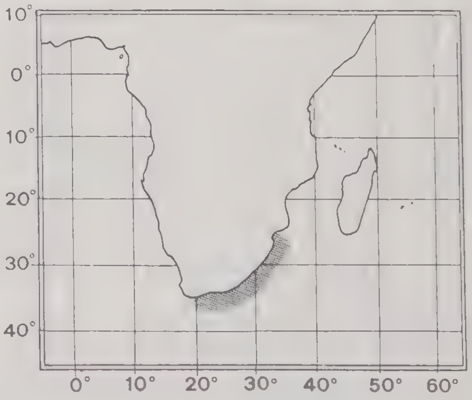
Diagnostic Features : First dorsal origin over pelvic insertions. Colour uniform brown with saddle marks obsolete or absent.



dermal denticle

Geographical Distribution : Western Indian Ocean: South Africa (southern Cape Province to southern Natal).

Habitat and Biology : A common temperate-water shark found close inshore on the continental shelf, often in shallow, rocky areas. In the southeastern Cape region of South Africa this species is sympatric with *H. edwardsii*, but there apparently is at least partial microhabitat separation between the two. The brown shyshark is an inshore species in the southeastern Cape, while *H. edwardsii*, the puffadder shyshark, occurs in deeper water offshore. The term 'shyshark' for this and other members of the genus *Haploblepharus* refers to their habit of curling up with their tails over their eyes when captured. Oviparous. Eats lobsters and bony fishes. Readily kept in captivity.



Size : Maximum 73 cm; adolescent male 53 cm, adult males 63 to 69 cm, adolescent female 59 cm, adult females 60 to 73 cm.

Interest to Fisheries : None at present, caught by sports anglers with rod and reel but apparently little-utilized.

Literature : Bass, D'Aubrey & Kistnasamy (1975a); Springer (1979).

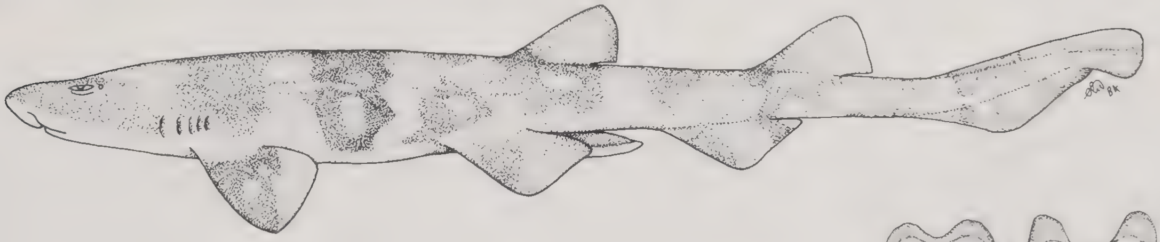
Haploblepharus pictus (Müller & Henle, 1838)

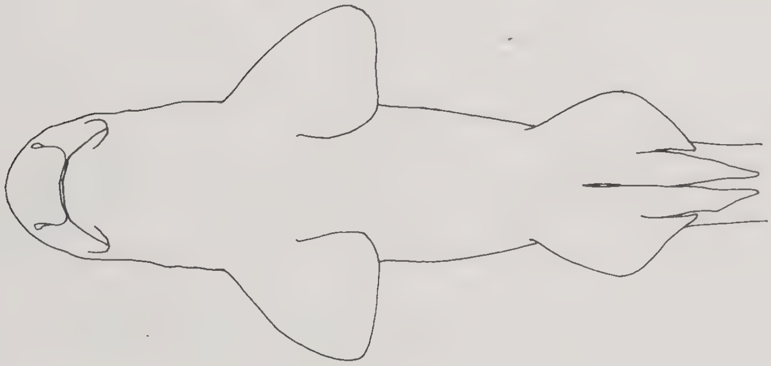
SCYL Hap 3

Scyllium pictum Müller & Henle, 1838, Syst.Beschr.Plagiost., pt. 1:4. Holotype: ?. Type Locality: Cape of Good Hope, South Africa.

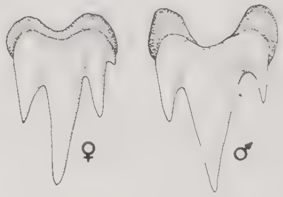
Synonymy : None.

FAO Names : En - Dark shyshark; Fr - Roussette sombre; Sp - Alitán obscuro.

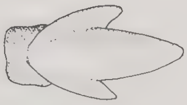




partial ventral view



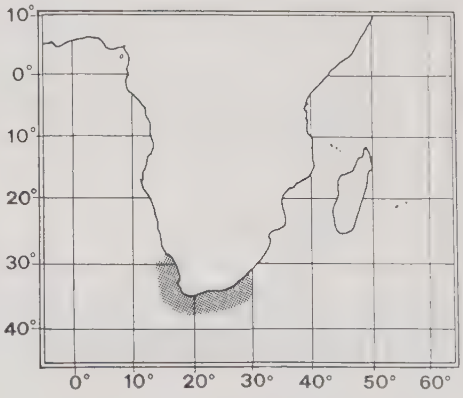
teeth



dermal denticle

Field Marks : A broad-headed, stout-bodied catshark with greatly expanded anterior nasal flaps that reach mouth and cover broad nasoral grooves, dorsolateral gill slits, variegated colour pattern with dorsal saddles, dotted with few large white spots and without dark margins.

Diagnostic Features : First dorsal origin in front of pelvic insertions. Colour pattern with striking dorsal saddles, not bordered with conspicuous darker margins; saddles dotted with sparse light spots, mostly larger than spiracles.



Geographical Distribution : Eastern South Atlantic: Namibia to South Africa (southwestern Cape Province).

Habitat and Biology : A common inshore bottom-dwelling shark of temperate waters of the continental shelf, commonest in shallow, sandy areas. Oviparous, with one egg laid per oviduct. Size of egg-cases about 6 cm long by 3 cm wide. In an aquarium an egg-case hatched in about 3.5 months.

Size : Maximum about 56 cm, adult male 56 cm, adult female 53 cm, size at hatching about 11 cm.

Interest to Fisheries : None at present, caught by sports anglers with rod and reel but little utilized.

Literature : Bass, D'Aubrey & Kistnasamy (1975a); Springer (1979).

Remarks : According to Bass, D'Aubrey & Kistnasamy (1975a), this species is largely allopatric to H. edwardsii with the boundary between it and H. edwardsii at False Bay, where both occur; and possibly is entirely allopatric to H. fuscus which has not been recorded as far west as False Bay.

Holohalaelurus Fowler, 1934

SCYL Hol

Genus : Subgenus Holohalaelurus Fowler, 1934 (Genus Halaelurus Gill, 1862). Proc.Acad.Nat.Sci.Philad., 75:235.

Type Species : Scylliorhinus regani Gilchrist, 1922, by original designation.

Synonymy : Genus Holohaelurus Fowler, 1967 (misspelling).

Field Marks : Extremely broad-headed short-snouted catsharks without labial furrows, with long mouths and long, low fins, slender tails, very bold, bright, spotted dorsal colour patterns and scattered black dots on underside of head.

Diagnostic Features : Body not tadpole-shaped, fairly stout and spindle-shaped, tapering considerably to caudal fin; body firm and thick skinned, with well-calcified dermal denticles; stomach not inflatable; tail moderately long, length from vent to lower caudal origin over 4/5 of snout-vent length. Head greatly depressed and very broad, narrowly pointed and somewhat wedge-shaped in lateral view; head short, less than 1/5 of total length in adults; snout rather short, less than 3/5 of mouth width, thin, and very flattened, pointed in lateral view; snout somewhat expanded laterally, rounded-parabolic and slightly bell-shaped in dorsoventral view; ampullal pores not greatly enlarged on snout; nostrils fairly large, with incurrent and excurrent apertures only partly open to exterior; anterior nasal flaps broadly triangular, without barbels, well separate from each other but nearly or quite reaching level of mouth; internarial space about 1 to 1.3 times the nostril width; no nasoral grooves; eyes dorsolateral on head, very broad subocular ridges present below eyes. Mouth semiangular, very long, with lower symphysis well behind upper so that upper teeth are exposed in ventral view; labial furrows absent from both jaws; branchial region not enlarged, distance from spiracles to fifth gill slits 2/5 of head length; gill slits dorsolateral on head. Two dorsal fins present, the second slightly larger than first; origin of first dorsal varying from about over the pelvic midbases to slightly in front of their insertions; origin of second dorsal about over the last third of the anal base; pectoral fins moderately large, their width subequal or somewhat less than mouth width; inner margins of pelvic fins not fused over claspers in adult males; claspers moderately long, slender and distally pointed, extending about half of their lengths behind the pelvic fin tips; anal fin moderately large and definitely elongated, about as large as pelvic fins or larger, and larger than the dorsals; base length 1.5 to 2 times second dorsal base; origin of anal well behind pelvic bases, and insertion separated from lower caudal origin by a broad space subequal to the anal base; caudal fin moderately elongated, between 1/4 to 1/5 of total length in adults. No crest of denticles on the caudal margins; supraorbital crests absent from cranium. Colour light with a conspicuous colour pattern of dark spots and blotches on dorsal surface, unique small black dots on underside of head.

Remarks : The writer follows Bigelow & Schroeder (1948), Bass, D'Aubrey & Kistnasamy (1975a), and Springer (1979) in recognizing this genus, though the differences between it and the closely related Halaelurus are fairly small. An alternate arrangement as originally proposed by Fowler (1934) is ranking this taxon as a subgenus of Halaelurus.

Key to Species :

1a. Anal base 3½ times its height or less. Colour pattern of very small regular, close-spaced dark spots on a light background, the light areas not appearing reticulated .... **H. punctatus**

1b. Anal base over 3½ times its height or less. Colour pattern usually of larger, somewhat irregular, very close-spaced dark spots on a light background, the light areas having a reticulated appearance .... **H. regani**

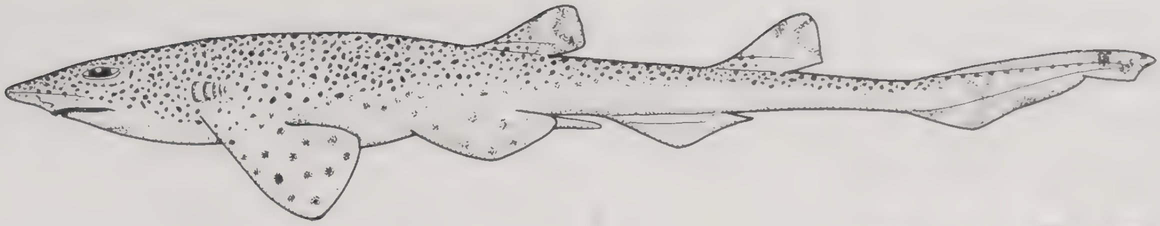
Holohalaelurus punctatus (Gilchrist, 1914)

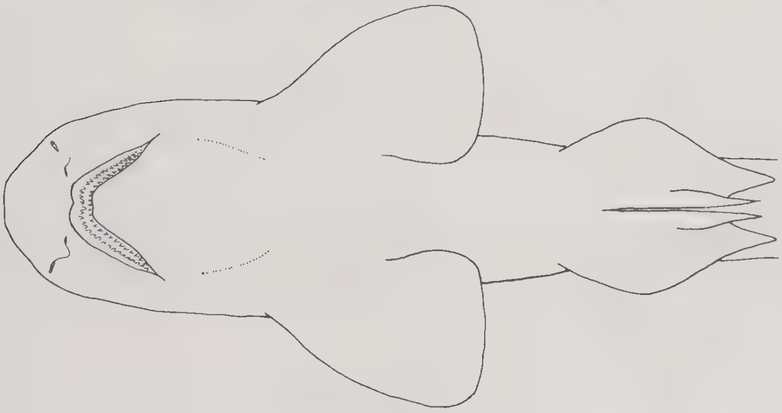
SCYL Hol 1

Scylliorhinus punctatus Gilchrist, 1914, Mar.Biol.Rep.Cape Town, (2):129. Holotype: ?. Type Locality: Cape Point, South Africa.

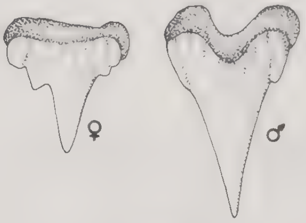
Synonymy : Scyliorhinus (Halaelurus) polystigma Regan, 1921.

FAO Names : En - African spotted catshark; Fr - Holbiche à gorge tachetée; Sp - Pejegato moteado.

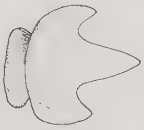




partial ventral view



teeth



dermal denticle

Field Marks : A catshark with an extremely broad head, no labial furrows, nostrils separate from each other and mouth, and without barbels or nasoral grooves, dorsolateral gill slits, dorsal fins equal-sized, first dorsal with origin about over rear end of pelvic bases, second dorsal base partly behind anal base, dorsal surface with dense covering of dark brown spots, underside of head with tiny dark dots, conspicuous white spot over pectoral insertion.

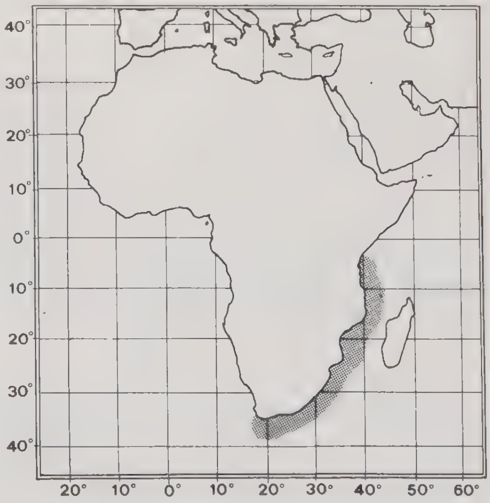
Diagnostic Features : Anal base $3\frac{1}{2}$ times its height or less, usually shorter than interdorsal space. Second dorsal fin about as large as first. Denticles on back and top of head of uniform size (but see remarks below). Colour pattern variable but usually with very small, regular, closely spaced dark brown spots on yellow-brown or orange-brown ground colour of back giving more of a leopard-like appearance; also longitudinal or double-V-shaped markings on dorsal fins, lined with white, and white spots on sides of body that are especially prominent above pectoral insertions. A smaller species, adult males 28+cm, adult females 24+cm.

Geographical Distribution : Western Indian Ocean: South Africa, Mozambique, possibly Tanzania (see remarks below).

Habitat and Biology : A small, common bottom-dwelling shark of deepish water of the uppermost continental slopes off Natal and southern Mozambique, but also recorded from Cape of Good Hope and Tanzania (Zanzibar). Off Natal, females are far outnumbered by males, but not off southern Mozambique, indicating partial sexual segregation. Development oviparous, with one egg-case being laid per oviduct at a time. Eats small bony fishes, crustaceans and cephalopods.

Size : Maximum about 34 cm; male adolescent 24 cm, adult males 29 to 34 cm; females immature at 20 cm, adolescent at 22 to 23 cm and adult at 24 to 26 cm. The adult males of this species are considerably larger than females in this species and H. regani, something unusual among sharks.

Interest to Fisheries : None at present, taken in bottom trawlers.



Literature : Bass, D'Aubrey & Kistnasamy (1975a); Springer (1979).

Remarks : See Bass, D'Aubrey & Kistnasamy (1975a) for a discussion of the synonymy of this species. These writers note that although the holotype and three of the four paratypes of Scyliorhinus (Halaelurus) melanostigma Norman, 1939, collected off Zanzibar and in the British Museum (Natural History) marine fish collection, are based on specimens of H. regani, the fourth paratype (BMNH 1939.5.24.5, a 210 mm female) is punctatus-like. This Zanzibar specimen differs from Natal punctatus in having a single narrow dark bar flanked by light lines on its dorsal fins (Natal specimens have twin V-marks on their dorsals). The writer was able to examine two additional specimens of this type from Tanzania, collected by G. Bianchi in 1982, and can confirm the colour differences. Additionally, these sharks agree with *H. regani* and not *H. punctatus* in having enlarged denticles interspersed with normal smaller ones, but have the shorter anal fin, small size, and general colour pattern of *H. punctatus*. As suggested by Bass, D'Aubrey & Kistnasamy, these Tanzanian sharks may represent an additional, undescribed species or a geographic variant of *H. punctatus*, but unfortunately there are no specimens from the intermediate area, northern Mozambique, to determine if the Natal-southern Mozambique and Tanzanian *punctatus* types intergrade or not. Springer (1979) reported a similar specimen from Tanzania (a 210 mm immature male, possibly not saved).

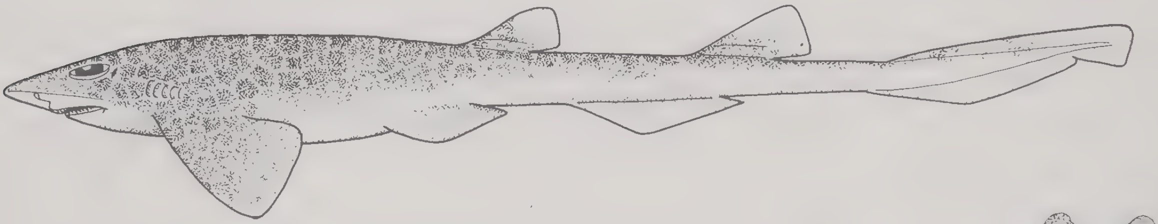
Holohalaelurus regani (Gilchrist, 1922)

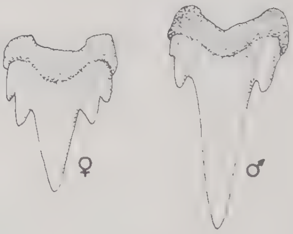
SCYL Hol 2

Scylliorhinus regani Gilchrist, 1922, Rep.Fish.Mar.Biol.Surv.Union South Africa, 2(spec.rept.3):45. Probable syntypes: J.L.B. Smith Institute of Ichthyology, Grahamstown, South Africa, RUSI 952, two females, 215 and 269 mm. Type Locality: "Cape Seas" (Cape of Good Hope, South Africa), from 174 to 320 m depth.

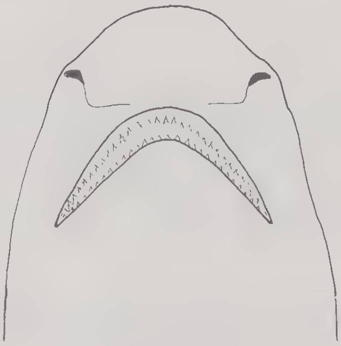
Synonymy : *Scyliorhinus (Halaelurus) melanostigma* Norman, 1939.

FAO Names : En - Izak catshark; Fr - Holbiche isard; Sp - Pejegato reticulado.

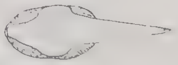




teeth



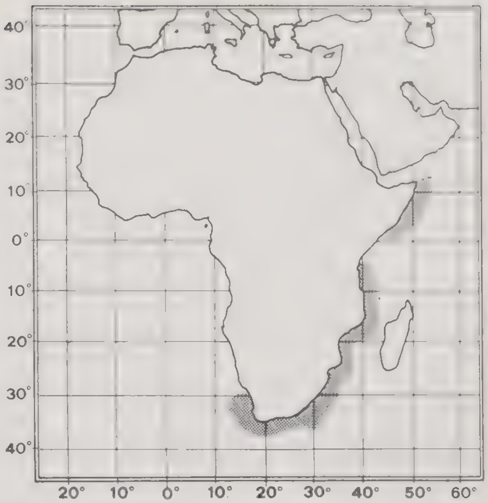
underside of head



dermal denticle

Field Marks : A catshark with an extremely broad head, no labial furrows, nostrils separate from each other and mouth, and without barbels or nasoral grooves, dorsolateral gill slits, second dorsal fin usually somewhat larger than first, first dorsal with origin about over rear end of pelvic bases, second dorsal base partly behind anal base, dorsal surface appearing dark brown with reticular pattern of light lines, underside of head with tiny dark dots, no conspicuous white spot over pectoral insertion in adults.

Diagnostic Features : Second dorsal fin usually larger than first; anal base over $3\frac{1}{2}$ times its height, usually longer than interdorsal space (except in very young individuals). Denticles on back and top of head not of uniform size, enlarged spiky denticles scattered among more numerous small denticles. Colour pattern variable but usually with large, irregular, sometimes light-centred, very closely-spaced brown spots on back giving back dark-brown cast with a reticular pattern of light lines; no white spot over pectoral insertion in adults, although young have a line of white spots on sides; dorsal fins of adults generally spotted but without dark lines or double-Vs. A larger species, adult males 50+cm and females 38+cm.



Geographical Distribution : Eastern South Atlantic and western Indian Ocean: South Africa, Mozambique, Tanzania, Somalia ?

Habitat and Biology : A common, deepish-water temperate and tropical catshark with a broad depth range from the outer continental shelf and upper slope on or near bottom at depths of 160 to 740 m. The species may occur in shallower water (160 to 460 m) at the Cape of Good Hope in the temperate region than off tropical-subtropical Tanzania and southern Mozambique (240 to 740 m).

Oviparous, one egg per oviduct laid at a time. Egg-cases about 3.5 by 1.5 cm. Hatchlings not recorded, but a 13 cm immature illustrated by Bass, D'Aubrey & Kistnasamy (1975a, fig. 15) is remarkable in being quite divergent in morphology from adults and subadults, with an all-dark body with white spots and black bars on fins, slender body, minute fins, and an extremely long tail.

Feeds heavily on cephalopods, with lesser amounts of bony fishes and crustaceans.

Size : Maximum 61 cm, males maturing at 50 to 54 cm and reaching 61 cm, females maturing at 38 to 39 cm and reaching 41 cm. As in H. punctatus, males are substantially larger than females. Size at hatching unknown, below 13 cm.

Interest to Fisheries : None at present, commonly taken by commercial bottom trawlers.

Literature : Fowler (1941); Bass, D'Aubrey & Kistnasamy (1975a); Springer (1979).

Remarks : Bass, D'Aubrey & Kistnasamy (1975a) note that the holotype of Scyliorhinus (Halaelurus) melanostigma and three of its four paratypes (all from off Zanzibar) are conspecific with H. regani (the fourth paratype is H. punctatus or a closely related species). These writers note considerable colour differences between H. regani specimens from the southwestern Cape Province of South Africa and those from Northern Natal and southern Mozambique. Without taking the problem further, Bass, D'Aubrey & Kistnasamy suggest that the wide-ranging H. regani might represent a group of closely related species (presumably with H. melanostigma one of these, as contrasted with the Cape H. regani), but with insufficient coverage of material these writers quite justifiably include all of the regani-like catsharks in one species.

Parmaturus Garman, 1906

SCYL Parm

Genus : Parmaturus Garman, 1906, Bull.Mus.Comp.Zool.Harv.Coll., 46(11): 203.

Type Species : Parmaturus pilosus Garman, 1906, by subsequent designation of Jordan (1920:518).

Synonymy : Genus Dichichthys Chan, 1966.

Field Marks : Flabby, soft-bodied catsharks with crests of saw-like denticles on dorsal (and sometimes ventral) caudal margin, rather small pectoral fins with width less than mouth width, usually short, rounded snouts less than mouth length, and subocular ridges well developed under eyes.

Diagnostic Features: Body not tadpole-shaped, slender and cylindrical, tapering slightly to caudal fin; body soft and flabby, with weakly calcified dermal denticles; stomach not inflatable; tail moderately long, length from vent to lower caudal origin about 4/5 of snout-vent length. Head slightly depressed, narrowly pointed-rounded in lateral view and not wedge-shaped; head short to moderately long, between 1/4 and 1/5 to less than 1/5 of total length in adults; snout short to moderately long, less than 4/5 of mouth width, thick, and slightly flattened, bluntly pointed in lateral view; snout not expanded laterally, rounded-parabolic and slightly bell-shaped in dorsoventral view; ampullal pores not greatly enlarged on snout; nostrils of moderate size, with incurrent and excurrent apertures only partly open to exterior; anterior nasal flaps broadly triangular, elongated and lobate, or reduced and pointed, without barbels, well separate from each other and falling somewhat anterior to mouth; internarial space about 0.8 to 1.1 times in nostril width; no nasoral grooves; eyes dorsolateral on head, narrow subocular ridges present below eyes; mouth angular or semiangular, moderately long with lower symphysis well behind upper so that upper teeth are exposed in ventral view; labial furrows present along both upper and lower jaws, these short and ending well behind level of upper symphysis of mouth; branchial region not greatly enlarged or slightly enlarged (P. xaniurus), distance from spiracles to fifth gill slit 2/5 to 3/5 of head length; gill slits lateral on head. Two dorsal fins present, about equal-sized or with second definitely larger than first; origin of first dorsal varying from slightly in front of the pelvic origins to about over their insertions; origin of second dorsal varies from about over the anal origin to slightly behind the anal midbase; pectoral fins moderately large, their width subequal or somewhat less than mouth width; inner margins of pelvic fins not fused over claspers in adult males; claspers moderately long, fairly thick, and distally pointed, extending about half of their lengths behind the pelvic fin tips; anal fin moderately large but not greatly elongated, about as large as pelvic fins or larger, subequal to larger than the second dorsal and larger than the first dorsal, its base length subequal to about 1.7 times second dorsal base; origin of anal close behind to far behind pelvic bases, and insertion separated from lower caudal origin by a narrow notch to a broad space over half the anal base; caudal fin moderately elongated, over or less than a fourth of total length in adults. A well-developed crest of denticles on the dorsal caudal margin, and sometimes on the preventral margin, dorsal crest rounded on its upper surface and somewhat asymmetrical in adults; small median denticles between upper crest denticles usually in more than five rows; supraorbital crests absent from cranium. Colour light grey or brown to dark grey or blackish-grey, without a conspicuous colour pattern.

Remarks: The genus Dichththys was proposed by Chan (1966) for D. melanobranchius. Springer (1979) reduced Dichichthys to a subgenus of Parmaturus, with P. melanobranchius and his new species P. campechiensis, while including P. pilosus and P. xaniurus in the nominate subgenus Parmaturus. Springer also proposed a new subgenus, Compagnoia, for P. manis and P. stenseni, which are Apristurus-like species more properly placed in that genus.

Recently Chu et al. (1983) placed P. melanbranchius and Galeus boardmani in the genus Figaro, along with their new species F. piceus. However, as a tentative measure I retain Springer's (1979) arrangement, however unsatisfactory, and retain melanobranchius in Parmaturus; Figaro piceus is considered a possible synonym based on the adult of P. melanobranchius. See the remarks under the genus Galeus for further comments on the genus Figaro, which, if constituted as Chu et al. (1983) suggest to include all the Parmaturus-Galeus-like species with subcaudal crests of denticles, would have to include Parmaturus pilosus, the type species of Parmaturus. This would make Figaro a junior synonym of Parmaturus, and would orphan P. xaniurus and P. campechensis, species without subcaudal crests that are respectively close to P. pilosus and P. melanobranchius. There may be a new species of Parmaturus off New Zealand, but this is uncertain at present.

Key to Species:

1a. Origin of first dorsal well behind pelvic origins .... **P. melanobranchius**

1b. Origin of first dorsal nearly or quite opposite pelvic origins

  2a. Anterior nasal flaps reduced to low points. Second dorsal larger than first and about as large as anal fin .... **P. campechensis**

  2b. Anterior nasal flaps large. Second dorsal about as large as first and much smaller than anal fin

    3a. Nasal flaps triangular. Second dorsal insertion well in front of anal insertion. No crest of enlarged denticles on preventral caudal margin .... **P. xaniurus**

    3b. Nasal flaps narrowly lobate. Second dorsal insertion about opposite anal insertion. A crest of enlarged denticles on preventral caudal margin .... **P. pilosus**

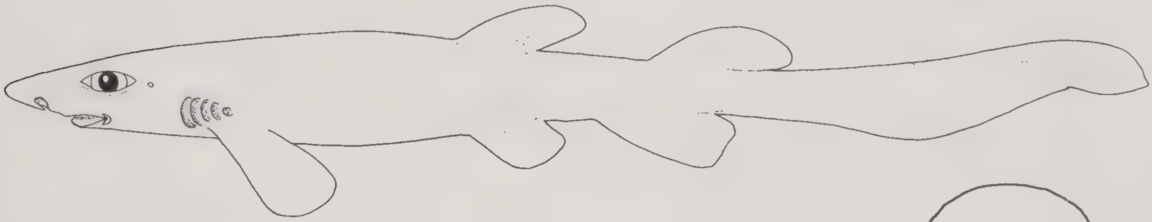
Parmaturus campechiensis Springer 1979

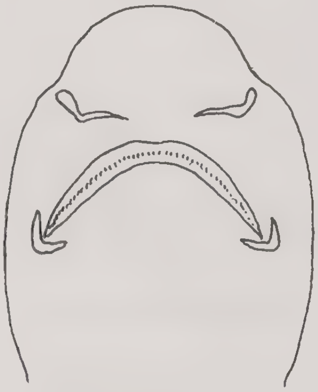
SCYL Parm 1

Parmaturus campechiensis Springer, 1979, NOAA Tech.Rep.NMFS Circ., (422):100, fig. 59. Holotype: U.S. National Museum, USNM 206184, 157 mm immature female. Type Locality: 21°33'N, 96°48'W, northwestern Bay of Campeche, Gulf of Mexico, 1097 m depth.

Synonymy : None.

FAO Names : En - Campeche catshark; Fr - Holbiche campèchoise; Sp - Pejegato campechano.





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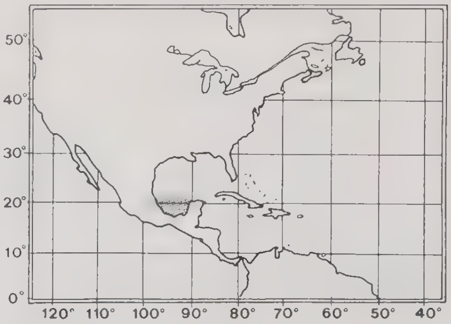
Field Marks : A deepwater, soft-bodied, plain catshark with a short snout, first dorsal origin about opposite pelvic origins, second dorsal larger than first, crest of denticles on dorsal caudal margin.

Diagnostic Features : Snout broadly rounded; anterior nasal flaps reduced to low points; gill septa excavated and concave posteriorly. First dorsal fin smaller than second; first dorsal origin over pelvic origins; first dorsal insertion slightly in front of pelvic insertions; second dorsal about as large as anal fin; second dorsal origin well behind anal origin; second dorsal insertion well behind anal insertion; ventral edge of caudal peduncle and preventral caudal margin without a crest of enlarged denticles.



Geographical Distribution : Known only from the type locality.

Habitat and Biology : A little-known deepwater catshark, from the western Atlantic continental slope on or near the bottom at 1097 m depth. Known only from the holotype.

Size : Maximum 16+cm (immature holotype).

Interest to Fisheries : None.

Literature : Springer (1979).

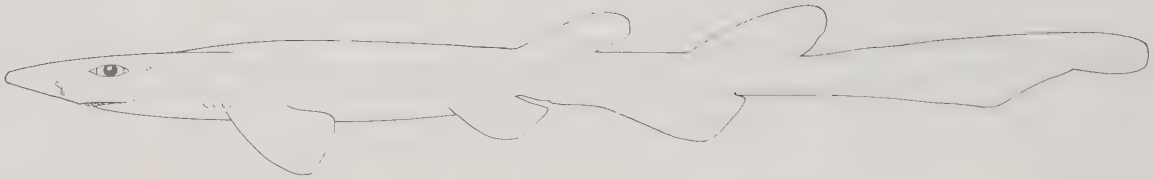
Parmaturus melanobranchius (Chan, 1966)

SCYL Parm 2

Dichththys melanobranchius Chan, 1966, J.Zool., Lond., 148:226, figs. 2-3, pl. 1b. Holotype: British Museum (Natural History), BMNH 1965.8.11.6, 235 mm immature female. Type Locality: 20°05'N, 115°03'E, 549 m depth.

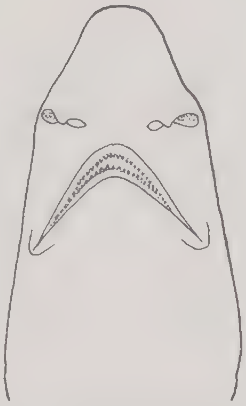
Synonymy : ? Figaro piceus Chu, Meng & Liu, 1983

FAO Names : En - Blackgill catshark; Fr - Holbiche à joues noires; Sp - Pejegato de agallas negras.



Field Marks : A deepwater, soft-bodied, plain catshark with a moderately short snout, first dorsal origin about opposite last half of pelvic bases, second dorsal larger than first, crest of denticles on dorsal and preventral caudal margins.

Diagnostic Features : Snout narrowly rounded; nasal flaps small and angularly pointed; gill septa excavated and concave posteriorly. First dorsal fin considerably smaller than second; first dorsal origin opposite last half of pelvic bases or over pelvic insertions; first dorsal insertion far behind pelvic insertions; second dorsal about as large as anal fin; second dorsal origin far behind anal origin; second dorsal insertion far behind anal insertion; ventral edge of caudal peduncle and preventral caudal margin with a partial crest of enlarged denticles.



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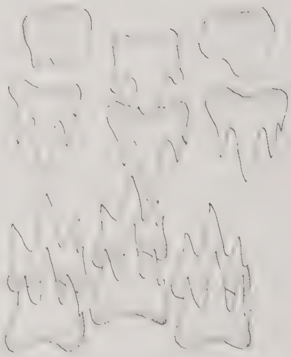


upper and lower teeth

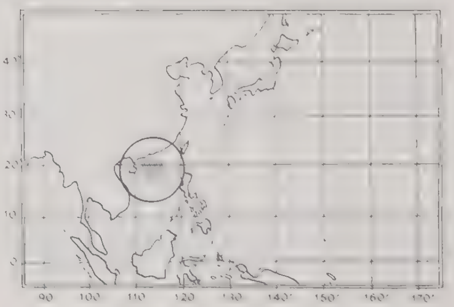
Geographical Distribution : Western North Pacific: South China Sea.

Habitat and Biology : A poorly known deepwater bottom-dwelling shark from the upper continental slopes off China, on mud bottom at depths of 549 to 810 m.

Size : Maximum 85 cm (female, possibly adult).

Interest to Fisheries : None.

Literature : Chan (1966); Springer (1979); Chu et al. (1983).



Remarks : Chu et al. (1983) recently described Figaro piceus from the South China Sea at 19°40'N, 115°E, 810 m (holotype, 85 cm) and 19°03'N, 113°27'E, 660 m (paratype, 46 cm). They distinguished this species from P. melanobranchius by its longer predorsal space (greater than first dorsal origin to caudal tip in piceus, less in melanobranchius), shorter caudal fin (distance from second dorsal insertion to caudal tip about 4.5 in piceus, 3.4 in melanobranchius as examined by the writer), and colour (uniform blackish brown versus light brown with blackish-brown distal parts and anterior margins of fins, snout tip, nostrils, and gills in melanobranchius). Unfortunately, the first two characters are much influenced by growth in scyliorhinids, and may merely indicate changes in proportions within a species (the holotype of melanobranchius being much smaller than the two piceus types). Changes in coloration with growth are also known for some deepwater scyliorhinids, such as Holohalaelurus regani. Chu et al. stated that their new species differed from the present one in having only the last 2 (rather than, last 4) gill slits over the pectoral bases, but examination of the holotype of melanobranchius revealed the same condition as in piceus.

The writer is inclined to include Figaro piceus in tentative synonymy of the present species because of their general similarity in morphology, but notes that the first dorsal origin as pictured for piceus is about over the last half of the anal base, but is about over its insertion in the holotype of melanobranchius. This may or may not be significant, particularly as only 3 specimens of these sharks are currently known and it is uncertain how variable they are in this feature. The illustration is taken from the holotype of melanobranchius.

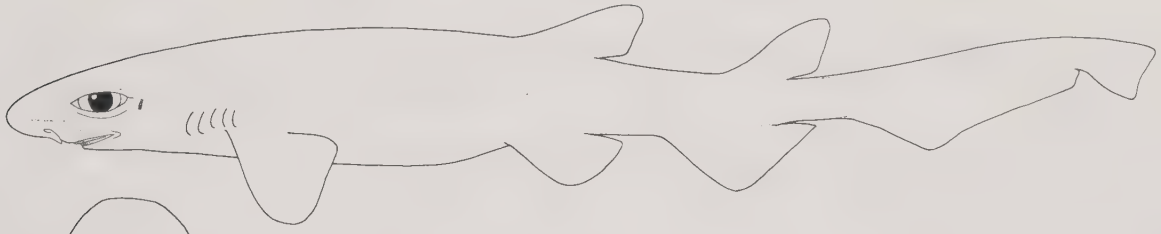
Parmaturus pilosus Garman, 1906

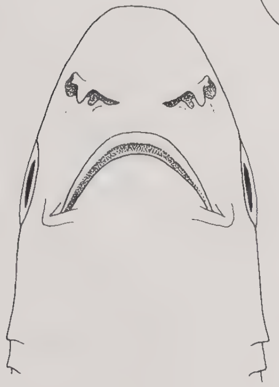
SCYL Parm 3

Parmaturus pilosus Garman, 1906, Bull.Mus.Comp.Zool.Harv.Coll., 46(11):204. Holotype: Museum of Comparative Zoology, Harvard, MCZ-1107, ca. 544 mm, immature male. Type Locality: Sagami Bay, Japan, 34°59'N, 139°31'E, 786 m depth.

Synonymy : Pristiurus hertwigi Engelhardt, 1912

FAO Names : En - Salamander shark; Fr - Holbiche salamandre; Sp - Pejegato salamandra.





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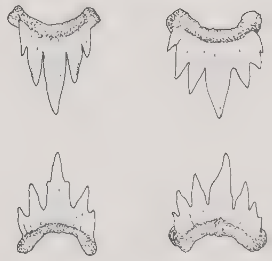
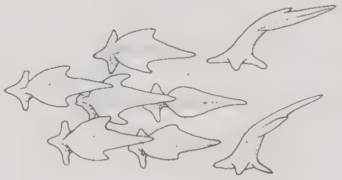


upper and lower teeth

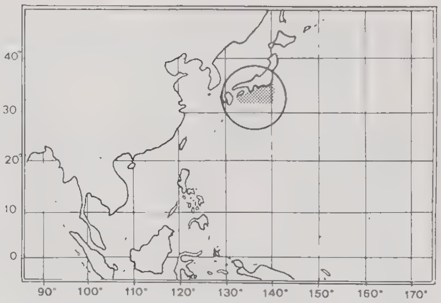


dorsal view lateral view

dermal denticles

Field Marks : A deepwater, soft-bodied, plain catshark with a moderately short snout, first dorsal origin just behind pelvic origins, second dorsal about as large as first, crest of denticles on dorsal and preventral caudal margins.

Diagnostic Features : Snout broadly rounded; nasal flaps large, narrow-based and lobate; gill septa not excavated and concave posteriorly. First dorsal fin about as large as second; first dorsal origin just behind pelvic origins; first dorsal insertion slightly behind pelvic insertions; second dorsal smaller than anal fin; second dorsal origin well behind anal origin; second dorsal insertion about over anal insertion; ventral edge of caudal peduncle and preventral caudal margin with a crest of enlarged denticles.



Geographical Distribution : Western North Pacific: Japan (southeastern Honshu).

Habitat and Biology : A little-known, but possibly common deepwater bottom-dwelling shark, on the continental slopes off Japan at 786 m depth (depth for the holotype, the only specimen for which this was recorded). Has a high concentration of squalene in its liver, as in many deepwater squaloids.

Size : Maximum at least 64 cm; males immature at 56 cm; state of maturity uncertain for females 59 to 64 cm.

Interest to Fisheries : Probably of minor importance in the past to some Japanese fishermen using deep-set longlines, but apparently seldom caught at present.

Literature : Garman (1913); Nakaya (1975); Springer (1979).

Remarks : Synonymy follows Springer (1979), who examined the holotype (now lost) of Pristiurus hertwigi.

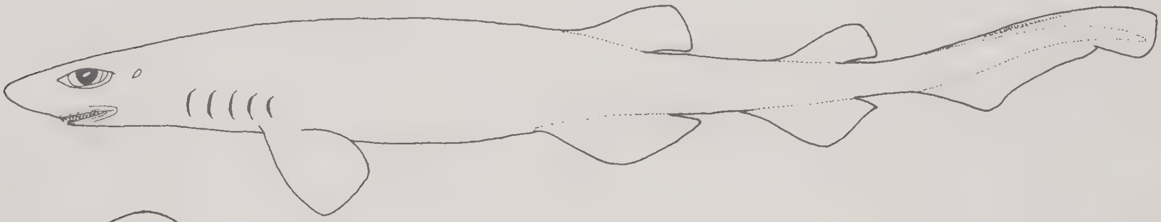
Parmaturus xaniurus (Gilbert, 1892)

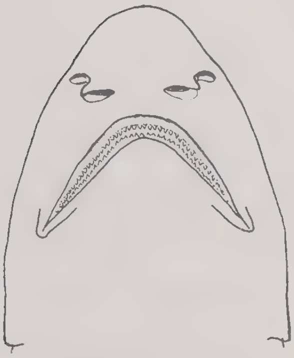
SCYL Parm 4

Catulus xaniurus Gilbert, 1892, Proc.U.S.Nat.Mus., 14(880):540. Lectotype: U.S. National Museum of Natural History, USNM-46719, 550 mm female, presumably adult, one of 8 syntypes designated lectotype by Springer (1979:108). Type Locality: Off southern California, USA, 33°55.5'N, 128°28'W in 687 m depth.

Synonymy : None.

FAO Names : En - Filetail catshark; Fr - Holbiche râpe; Sp - Pejegato lima.





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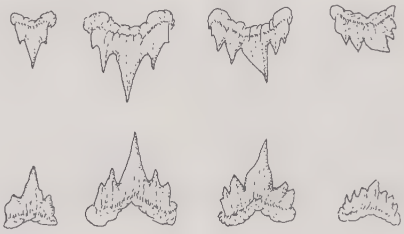
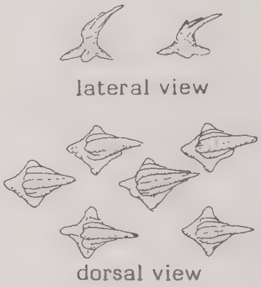


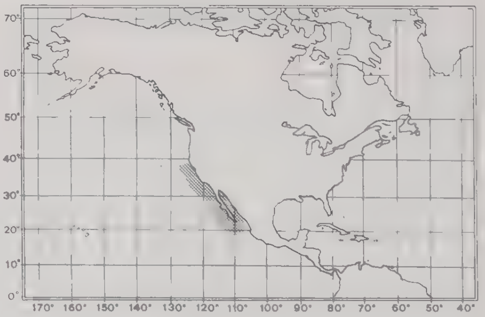
upper and lower teeth



dermal denticles

Field Marks : A deepwater soft-bodied, plain catshark with a short snout, first dorsal origin just behind pelvic origins, second dorsal about as large as first, crest of enlarged denticles on dorsal caudal margin.

Diagnostic Features : Snout broadly rounded; nasal flaps broad and triangular; gill septa not excavated and concave posteriorly. First dorsal fin about as large as second; first dorsal origin just behind pelvic origins; first dorsal insertion slightly in front of pelvic insertions; second dorsal smaller than anal fin; second dorsal origin nearly over anal origin; second dorsal insertion well in front of anal insertion; ventral edge of caudal peduncle and preventral caudal margin without a crest of enlarged denticles.



Geographical Distribution : Eastern North Pacific: Central California, USA, to Gulf of California, Mexico.

Habitat and Biology : A common but little-known deepwater shark of temperate to subtropical waters on the outer continental shelf and upper slope, often on or near the bottom but up to 490 m above, at depths of 91 to 1251 m. Has been seen from a deep-diving submersible on or near the bottom in the Santa Barbara Basin, an anoxic area with few if any other vertebrates commonly living in it. Apparently the enlarged gill region of this shark is an adaption to living in areas of low oxygen, as in the triakid Iago omanensis and presumably the bizarre, long-headed catshark Cephalurus cephalus.

Oviparous, egg-cases about 7 to 11 cm long by 3 to 4 cm wide, with unusual T-shaped lateral flanges. An egg collected in water at a temperature 6°C was kept in a refrigerator, but was only half developed when it died about a year later.

Probably eats a variety of small fish and invertebrate prey. Individuals were seen eating moribund lanternfish in the anoxic Santa Barbara Basin.

As in P. pilosus this species has a high concentration of squalene in its liver, which probably helps to adjust it to approximately neutral buoyancy.

Size : Maximum 55 cm; adult males 37 to 45 cm; adult females 47 to 55 cm.

Interest to Fisheries : Regularly caught by bottom trawlers, but apparently not utilized at present.

Literature : Roedel & Ripley (1950); Miller & Lea (1972); Springer (1979).

Pentanchus Smith & Radcliffe, 1912

SCYL Pent

Genus : Pentanchus Smith & Radcliffe, 1912, Proc.U.S.Nat.Mus, 41(1872):490.

Type Species : Pentanchus profundicolus Smith & Radcliffe, 1912, by original designation.

Synonymy : None unless Apristurus Garman, 1913, is a junior synonym.

Diagnostic Features : Essentially those of Apristurus, but without a first dorsal fin (possibly abnormal, see below). Body not tadpole-shaped, stocky and compressed, increasing in height up to the pectoral and trunk region and tapering posteriorly; body soft and flabby, with thin skin and weakly calcified dermal denticles; stomach probably not inflatable; tail short, length from vent to lower caudal origin about 3/5 of snout-vent length. Head greatly depressed, pointed and wedge-shaped in lateral view; head elongated, but slightly less than 1/4 of total length (adult male); snout elongated, its length greater than mouth width, greatly flattened, narrow and pointed in lateral view; snout expanded laterally, narrowly spatulate and bell-shaped in dorsoventral view; ampullal pores enlarged and prominent on snout; nostrils enlarged, with incurrent and excurrent apertures broadly open to exterior; anterior nasal flaps reduced to angular lobes, without barbels, widely separate from each other and falling far anterior to mouth; internarial space 0.9 times in nostril width; no nasoral grooves; eyes dorsolateral on head, broad subocular ridges present below eyes; mouth broadly arched, with lower symphysis well behind upper so that upper teeth are exposed in ventral view; labial furrows present along both upper and lower jaws; these long and reaching to level of upper symphysis of mouth; branchial region not greatly enlarged, distance from spiracles to fifth gill slits less than half head length; gill slits lateral on head. Origin of second dorsal fin about over the anal midbase; pectoral fin width less than mouth width; inner margins of pelvic fins not fused over claspers in adult males; claspers short, thick, and distally pointed, not extending more than 2/3 of their length behind the pelvic fin tips; anal fin enlarged and greatly elongated, larger than pelvic fins and dorsal fin, base length over twice second dorsal base; origin of anal just behind pelvic bases, and insertion separated from lower caudal origin by a narrow notch; caudal fin elongated, over a fourth of total length. No crests of enlarged denticles on the caudal margins; supraorbital crests absent from cranium. No colour pattern, uniformly dark brown.

Remarks : This genus, which differs from the closely similar Apristurus only in lacking a first dorsal fin, has been recognized by Garman (1913), Bigelow & Schroeder (1948), and Springer (1979), although Fowler (1934, 1941), following a suggestion by Regan (1912), considered the single species unidorsate only by abnormality or injury and the genus a senior synonym of Apristurus Garman, 1913. Springer (1979) noted that Pentanchus profundicolus, known from the holotype only, also differed from Apristurus species in its very short body cavity, narrower snout, and longer anal fin base. However, I compared the holotype of P. profundicolus with the holotype and only known specimen of Apristurus herklotsi (both specimens from the Philippines) and found that these specimens were very close in numerous details, including the additional characters cited by Springer (1979) as separating Pentanchus from Apristurus. This comparison suggested that the two holotypes are conspecific, that P. profundicolus is a senior synonym of A. herklotsi, that the holotype of P. profundicolus is abnormal in lacking a first dorsal fin, and that Pentanchus is a senior synonym of Apristurus. The writer hesitates to substitute Pentanchus for the extensively used Apristurus at present, especially with the lack of further specimens of herklotsi-profundicolus catsharks from the Philippines, and tentatively retains herklotsi in Apristurus pending collection of more Philippine Apristurus.

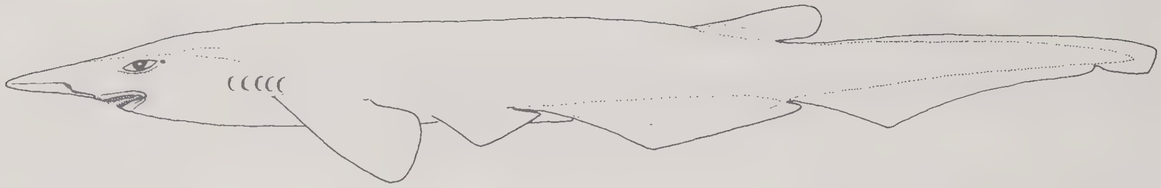
Pentanchus profundicolus Smith & Radcliffe, 1912

SCYL Pent 1

Pentanchus profundicolus Smith & Radcliffe, in Smith, 1912, Proc.U.S.Nat.Mus., 41(1872):490, fig., pl. 42. Holotype: U.S. National Museum of Natural History, USNM 70260, 508 (now 495) mm adult male. Type Locality: Between Mindanao and Leyte Islands, Mindanao Sea, the Philippines, 10°02'N, 125°19.3'E, 1070 m.

Synonymy : See remarks under genus.

FAO Names : En - Onefin catshark; Fr - Holbiche voile; Sp - Pejegato velero.



Field Marks: If its unidorsate condition is normal, this is the only shark with 5 pairs of gill slits and one dorsal fin. It otherwise resembles Apristurus herklotsi.

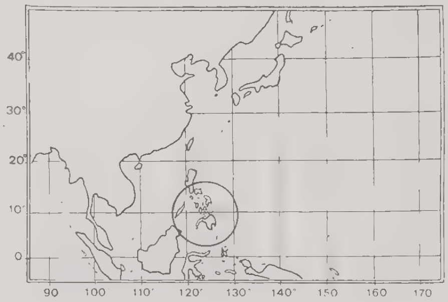
Diagnostic Features: See genus.

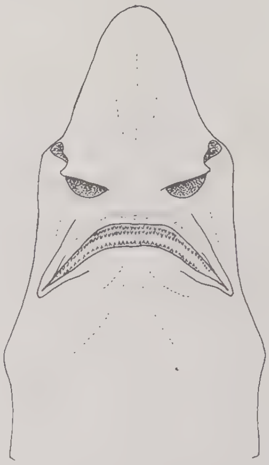
Geographical Distribution: Western North Pacific: The Philippines (Mindanao Sea).

Habitat and Biology: A poorly known deepwater bottom-dwelling shark inhabiting the insular slopes of the Mindanao Sea.

Size: The holotype and only known specimen is a 508 mm adult male.

Interest to Fisheries: None.





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Literature: Smith (1912); Fowler (1941); Springer (1979).

Remarks: See discussion above under the genus Pentanchus for notes on the possible synonymy of Apristurus herklotsi with P. profundicolus. The illustration is taken from the holotype.

Poroderma Smith, 1837

SCYL Por

Genus: Poroderma Smith, 1837, Proc.Zool.Soc.Lond., 5:85 (no description, but with allocation of 4 species including one previously named, "Scyllium africanum Cuvier", = Squalus africanus Gmelin, 1789).

Type Species: Squalus africanus Gmelin, 1789, by subsequent designation of Fowler (1908:53).

Synonymy: Subgenus Conoporoderma Fowler, 1934 (genus Poroderma).

Field Marks: Very stocky, compressed scyliorhinids with conspicuous trilobate anterior nasal flaps that include prominent conical barbels, second dorsal fin much smaller than first, short labial furrows on both jaws, and bold colour patterns of horizontal bars or rows of dark spots.

Diagnostic Features: Body not tadpole-shaped, very stout and rather compressed, tapering considerably to caudal fin; body firm and thick skinned, with well-calcified dermal denticles; stomach not inflatable; tail moderately short, length from vent to lower caudal origin between 1/2 and 3/5 of snout-vent length. Head slightly depressed, narrowly rounded and not wedge-shaped in lateral view; head short, less than 1/5 of total length in adults. Snout short, less than 3/4 of mouth width, thick, and slightly flattened, bluntly pointed in lateral view; snout not expanded laterally, rounded-parabolic in dorsoventral view; ampullal pores not greatly enlarged on snout; nostrils not enlarged, with incurrent and excurrent apertures only slightly open to exterior; anterior nasal flaps divided into three prominent lobes, a subangular medial lobe, elongated, pendulous lateral lobe, and a long conical barbel between them; anterior nasal flaps well separated from each other but with barbels falling short of mouth or reaching it; internarial space 0.6 to 0.8 times in nostril width; nasoral grooves absent; eyes dorsolateral on head, broad subocular ridges present below eyes; mouth broadly arched, moderately long, with lower symphysis somewhat behind upper so that upper teeth are well-exposed in ventral view; labial furrows present along both upper and lower jaws, these relatively short; uppers little expanded in front of mouth corners and falling well behind level of upper symphysis of mouth; branchial region not greatly enlarged, distance from spiracles to fifth gill slits 1/2 to 2/5 head length; gill slits lateral on head. Two dorsal fins present, with the second considerably smaller than the first; origin of first dorsal about over pelvic insertions; origin of second dorsal over the anal midbase; pectoral fins large, their width considerably greater than mouth width; inner margins of pelvic fins partly fused over claspers in adult males, forming a partial 'apron'; claspers very short, thick, and distally rounded, not extending behind the pelvic fin tips; anal fin moderately large but not greatly elongated, subequal to pelvic and first dorsal fins but much larger than second dorsal; anal base length 1.6 to 2.2 times that of second dorsal base; origin of anal well behind pelvic bases, and insertion separated from lower caudal origin by a space less than half as long as the anal base; caudal fin very short and broad, less than a fifth of total length in adults. No crest of denticles on the dorsal caudal margin; supraorbital crests present on cranium. Colour light grey with a striking variegated colour pattern of horizontal rows of dark spots or rosettes of spots and bars, or horizontal bars, on dorsal surface and sides of body.

Remarks : Poroderma was without description until Garman's (1913) account of it, in which it was restricted to P. africanum and P. pantherinum and fully diagnosed and described. Earlier, Fowler (1908) had revived the genus for P. africanum and P. stellare (= Scyliorhinus stellaris), but did not distinguish it.

Poroderma is close to Scyliorhinus but differs in being generally stouter-bodied and more compressed, having smaller spaces between the anal and caudal fin, definite short upper labial furrows, and trilobate, deeply notched anterior nasal flaps, with the medial ridge expanded to a prominent conical barbel and flanked basally by a pair of lobes. At most, Scyliorhinus species have a low medial ridge with a posterior low point on the triangular anterior nasal flaps, which are not subdivided and do not have conspicuous barbels. Scyliorhinus species often have colour patterns that are variants on dorsal saddles and spots, while Poroderma has longitudinal dark stripes or lines of spots or rosettes of spots and bars. Poroderma bears a similar relationship to Scyliorhinus as does the squaloid Cirrhigaleus to its close relative Squalus.

Bigelow & Schroeder (1948) used the genus Conoporoderma for P. pantherinum and P. marleyi, stating that Poroderma and its type species P. africanum were properly placed in the genus Scyliorhinus. The writer follows the arrangement of Fowler (1934, 1941), Bass, D'Aubrey & Kistnasamy (1975) and Springer (1979), who include these three species in the genus Poroderma.

Key to Species :

1a. Colour pattern of dark horizontal stripes, no spots .... **P. africanum**

1b. Colour pattern of dark spots or rosettes of spots and bars

  2a. Colour pattern of large dark spots .... **P. marleyi**

  2b. Colour pattern of rosettes of spots or spots and bars .... **P. pantherinum**

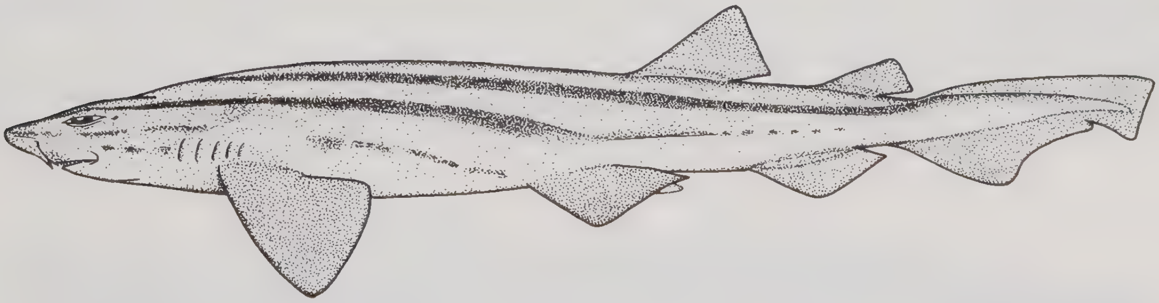
Poroderma africanum (Gmelin, 1789)

SCYL Por 1

Squalus africanus Gmelin, 1789, Caroli Linnaei Syst.Nat., 1(3):1494. Holotype: ?. Type Locality: "Mari Africanum".

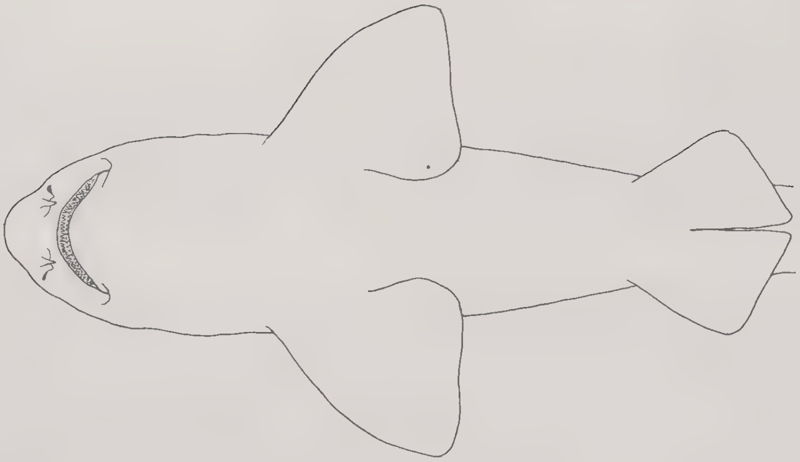
Synonymy : Squalus vittatus Shaw & Nodder, 1798; Squalus striatus Lichtenstein, 1844.

FAO Names : En - Striped catshark; Fr - Roussette rubanée; Sp - Alitán listado.

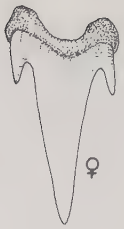


Field Marks : The striking longitudinal stripes, nasal barbels and posterior dorsal fins of this catshark make it unmistakable.

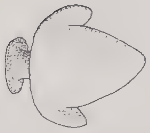
Diagnostic Features : Barbels of anterior nasal flaps short, less than half the nostril width, and usually not reaching mouth. Colour pattern of dark longitudinal stripes.



partial ventral view

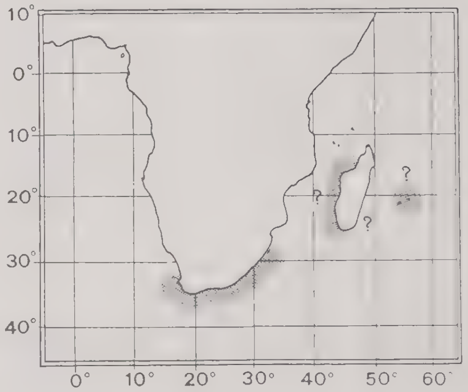


tooth



dermal denticle

Geographical Distribution : Eastern South Atlantic and western Indian Ocean: South Africa; also old records from Madagascar and Mauritius, but these require confirmation.



Habitat and Biology : A common inshore temperate shark in waters of the Cape Province of South Africa, especially the southwestern Cape, on or near the bottom from close inshore at the surfline to 100 m. Commonly found in caves and in rocky areas. A hardy nocturnal species, readily kept in captivity.

Oviparous, laying a single egg-case per oviduct; in an aquarium an egg hatched after about 5½ months.

Feeds heavily on crustaceans but also eats bony fishes and cephalopods.

Size : Maximum 101 cm; males maturing between 58 and 78 cm and reaching 101 cm, females maturing between 65 and 72 cm and reaching 93 cm. Size at hatching from 14 to 15 cm.

Interest to Fisheries : Limited, frequently taken by bottom trawlers and shore and boat anglers.

Literature : Garman (1913); Fowler (1941); Smith (1949); Bass, D'Aubrey & Kistnasamy (1975).

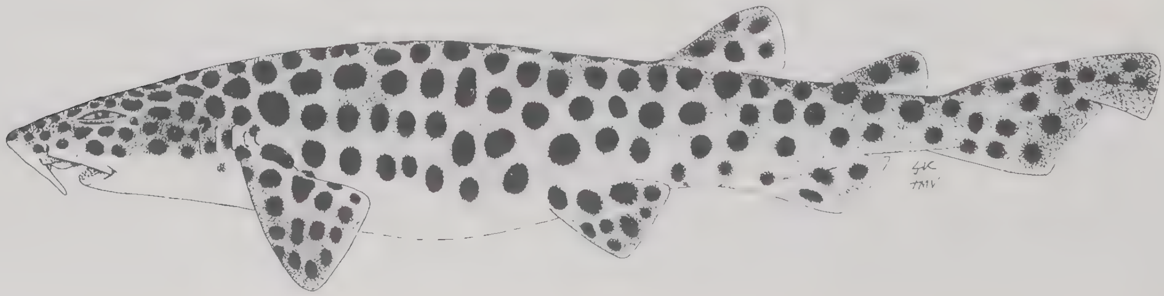
Poroderma marleyi Fowler, 1934

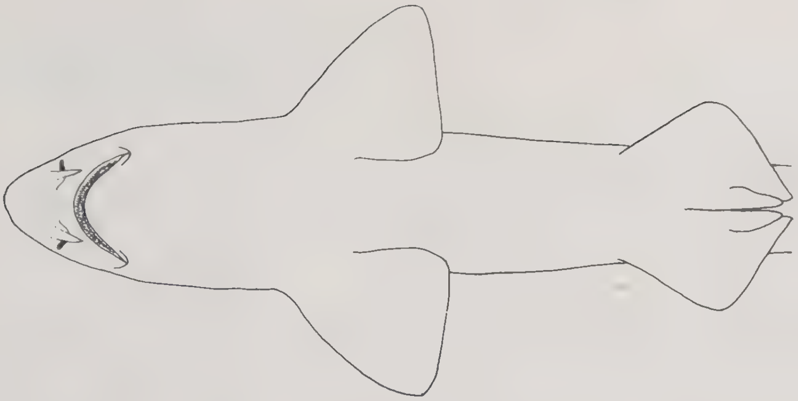
SCYL Por 2

Poroderma marleyi Fowler, 1934, Proc.Acad.Nat.Sci.Philad., 75:234. Holotype: Academy of Natural Sciences, Philadelphia, ANSP 53427, 225 mm immature female. Type Locality: Natal, South Africa, 37 m depth.

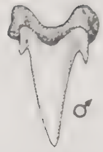
Synonymy : Scyliorhinus leopardus Fowler, 1935 (error for P. marleyi).

FAO Names : En - Barbeled catshark; Fr - Roussette barbichette; Sp - Alitán de barbilla.

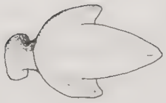




partial ventral view



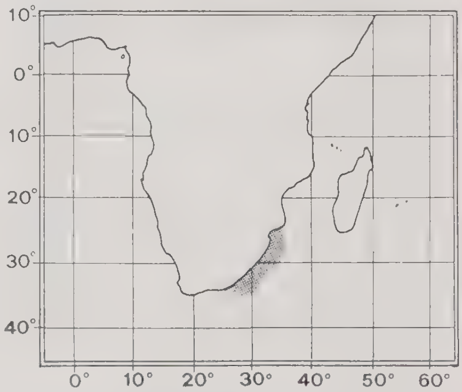
tooth



dermal denticle

Field Marks: Long nasal barbels, nictitating eyelids, mouth extending behind front of eyes, posterior dorsal fins with the first much larger than the second, and bold, spotted colour pattern with large dark spots.

Diagnostic Features: Barbels of anterior nasal flaps longer, nearly or quite equal to nostril width, and usually reaching mouth. Colour pattern of very large dark spots in irregular longitudinal rows, not forming rosettes.



Geographical Distribution: Known only from the Natal and Transkei coasts of South Africa, southwestern Indian Ocean.

Habitat and Biology: A rare, poorly known, small temperate and subtropical shark, found down to at least 37 m depth in South African waters. About 5 specimens known.

Size: Maximum recorded 65 cm, males adult at 58 cm.

Interest to Fisheries: None at present.

Literature: Fowler (1934, 1941); Smith (1949); Bass, D'Aubrey & Kistnasamy (1975).

Remarks: A specimen of this species was taken off Port St. Johns, Transkei, South Africa, while the writer was in South Africa in 1982. The possibility exists that this rare shark, which apparently differs from P. pantherinum only in its colour pattern, is a colour morph of the latter species. Bass, D'Aubrey & Kistnasamy (1975) suggested that this species differed from P. pantherinum, in having its anal origin slightly behind the first dorsal insertion (below or ahead of it in the latter species), but this is incorrect as shown by the Port St. Johns specimen.

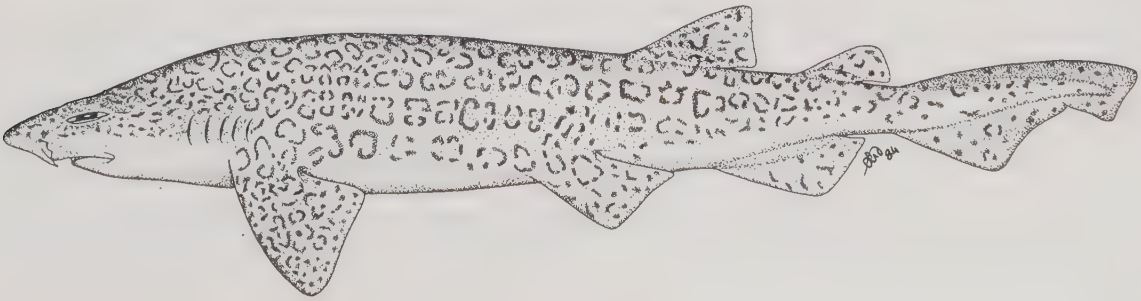
Poroderma pantherinum (Smith, 1838)

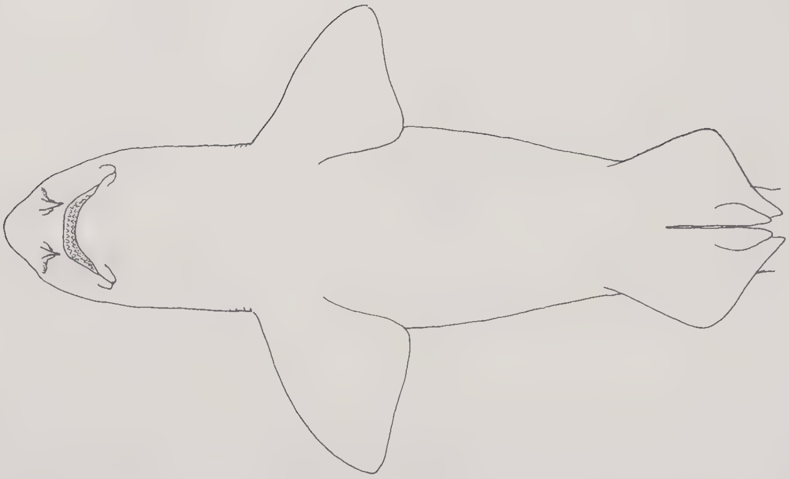
SCYL Por 3

Scyllium pantherinum Smith, in Müller & Henle, 1838, Syst.Beschr.Plagiost., (pt.1):13. Holotype: British Museum (Natural History), BMNH 45.7.3.145, 650 mm female. Type Locality: Cape of Good Hope, South Africa.

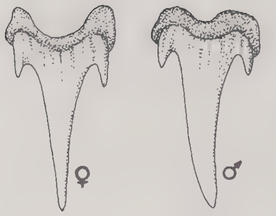
Synonymy: Poroderma pantherinum Smith, 1837 (name only); ? Poroderma submaculatum Smith, 1837 (name only); Poroderma variegatum Smith, 1837 (name only); Scyllium variegatum Smith, in Müller & Henle, 1838; Scyllium leopardinum Müller & Henle, 1838 (name only); Scyllium malandrinum Rapp, in Müller & Henle, 1838 (name only).

FAO Names: En - Leopard catshark; Fr - Roussette panthère; Sp - Alitán leopardo.

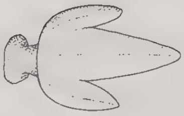




partial ventral view



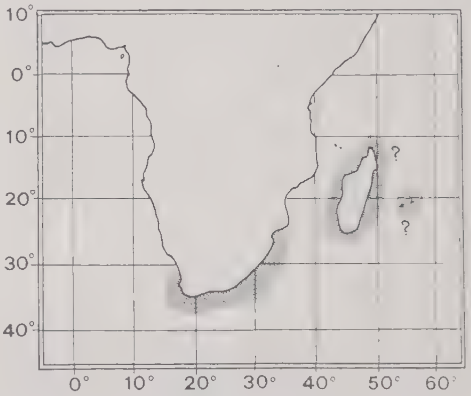
teeth



dermal denticle

Field Marks : Striking leopard-like colour pattern, nasal barbels, first dorsal fin positioned posteriorly.

Diagnostic Features : Barbels of anterior nasal flaps longer, nearly or quite equal to nostril width, and usually reaching mouth. A striking, very handsome, leopard-like colour pattern of rosettes of dark spots and lines surrounding light centres, arranged in irregular longitudinal rows.



Geographical Distribution : Eastern South Atlantic and western Indian Ocean: South Africa, Mauritius, Madagascar. Mauritius and Madagascar records require confirmation.

Habitat and Biology : This attractive, small, stocky catshark is common in shallow temperate continental waters of South Africa, particularly in the vicinity of Algoa Bay, southeastern Cape region, but also to the west Cape and rarely up to Natal. Depths range from close inshore at the surf zone to the uppermost slopes at 256 m, on or near the bottom. Apparently nocturnal, and readily kept in cavity.

Reproduction oviparous.

Food includes small bony fishes, crustaceans and cephalopods.

Size : Maximum 84 cm; males maturing between 54 and 59 cm and reaching 84 cm; females maturing between 58 and 61 cm and reaching at least 73 cm.

Interest to Fisheries : None or limited, commonly taken by bottom trawlers and shore and boat anglers.

Literature : Garman (1913); Fowler (1941); Smith (1949); Bass, D'Aubrey & Kistnasamy (1975).

Remarks : As noted by Bass, D'Aubrey & Kistnasamy (1975a), this species is rather variable in colour pattern, showing ontogenetic and geographic variation as well as individual differences. Examination of considerable series of specimens in the collections of the J.L.B. Smith Institute of Ichthyology suggest that the range of variation in this species, from numerous small dark spots, lines of rosettes of spots and circular bars, lines of mostly circular bars partially enclosing light centres, through lines of mixes larged light centred dark spots and circular bars, may grade into colour pattern of Poroderma marleyi with lines of large dark spots. This problem is being studied by the writer.

Schroederichthys Springer, 1966

SCYL Schroed

Genus : *Schroederichthys* Springer, 1966, *Fish.Bull.U.S.Fish Wildl.Serv.*, 65(3):604

Type Species : *Schroederichthys maculatus* Springer, 1966, by original designation.

Synonymy : None.

Field Marks : Scyliorhinids with short and rounded snouts, no nasoral grooves, anterior nasal flaps small and not reaching mouth, labial furrows present on both jaws, short to moderately long, not reaching upper symphysis, dorsal fins equally large at midbases, caudal fin short, without enlarged denticles on dorsal margin, supraorbital crests present on cranium, colour pattern of spots and saddles present.

Diagnostic Features : Body not tadpole-shaped, moderately stout to very slender, and cylindrical or spindle-shaped, tapering moderately to considerably to caudal fin; body firm and thick skinned, with well-calcified dermal denticles; stomach not inflatable; tail rather long, length from vent to lower caudal origin about 0.9 to 1.4 times in snout-vent length. Head moderately depressed, narrowly rounded and not wedge-shaped in lateral view; head short, less than 1/5 of total length in adults; snout short, less than 3/4 of mouth width, thick, and flattened, bluntly pointed in lateral view; snout not expanded laterally, rounded-parabolic and slightly bell-shaped in dorsoventral view; ampullal pores not greatly enlarged on snout; nostrils enlarged, but with incurrent and excurrent apertures only slightly open to exterior; anterior nasal flaps formed as broad triangular or narrow attenuated lobes without barbels, well separated from each other and ending slightly anterior to mouth; internarial space about 0.8 to 1.2 times in nostril width; nasoral grooves absent; eyes dorsolateral on head, broad subocular ridges present below eyes; mouth angular or arched, moderately long, with lower symphysis somewhat behind upper so that upper teeth are well-exposed in ventral view; labial furrows present along both upper and lower jaws, these short to rather long and extending nearly to level of upper symphysis of mouth or ending well behind it; branchial region not greatly enlarged, distance from spiracles to fifth gill slits about 2/5 to 3/5 of head length; gill slits lateral on head. Two dorsal fins present, about equal-sized or with the second slightly larger than the first; origin of first dorsal varying from about over pelvic midbases to over or slightly behind their insertions; origin of second dorsal varying from over the anal midbase to about over the anal insertion; pectoral fins moderately large, their width slightly less to considerably greater than mouth width; inner margins of pelvic fins not fused over claspers in adult males; claspers moderately long, fairly thick, and distally pointed, extending about half of their lengths or slightly less behind the pelvic fin tips; anal fin small and not greatly elongated, slightly smaller to slightly larger than pelvic fins, subequal to slightly smaller than dorsal fins, base length subequal to about 1.3 times the second dorsal base; origin of anal far behind pelvic bases, and insertion separated from lower caudal origin by a broad space varying from 1.2 to over 2 times the anal base; caudal fin short and broad to moderately elongated, less than a fifth of total length in adults. No crests of denticles on the caudal margins; supraorbital crests present on cranium. Colour dark grey or brown to tan with a variegated colour pattern of dark and white spots, and dark to dusky saddles on the sides and dorsal surface.

Remarks : Springer (1966), originally proposed this genus for his two new dwarf South American Atlantic species *S. maculatus* and *S. tenuis*, which supposedly differed from other scyliorhinids in their extremely attenuated forms. Subsequently, Springer (1979) discovered that one of these species, *S. tenuis* grew to a relatively large size, and that its attenuateness was a juvenile character. The slender body of adult *S. maculatus* may be a juvenile characteristic retained in a dwarf adult, that is, a result of pedomorphosis. Also, two additional South American species of South American scyliorhinids formerly placed in *Halaelurus* (*H. bivius* and *H. chilensis*) were found by Springer to belong to this genus. In *S. bivius* at least, newly hatched individuals are as attenuate as adult *S. maculatus*.

Schroederichthys is close to *Aulohalaelurus* and *Atelomycterus* and needs to be critically compared with them.

Key to Species :

1a. Anterior nasal flaps broad and triangular

    2a. Dorsolateral surfaces with conspicuous dark saddles and numerous dark spots, white spots few or absent. Adults to at least 63 cm .... **_S. chilensis_**

    2b. Dorsolateral surface with saddles only slightly darker than background or absent, white spots numerous. Adults to only 35 cm .... **_S. maculatus_**

1b. Anterior nasal flaps narrow and lobate

    3a. Dorsolateral surface with dark saddles and numerous dark spots, which are scattered and do not outline the saddles; white spots usually present .... **_S. bivius_**

    3b. Dorsolateral surface with dark saddles outlined by numerous dark spots; white spots usually absent .... **_S. tenuis_**

Schroederichthys bivius (Smith, 1838)

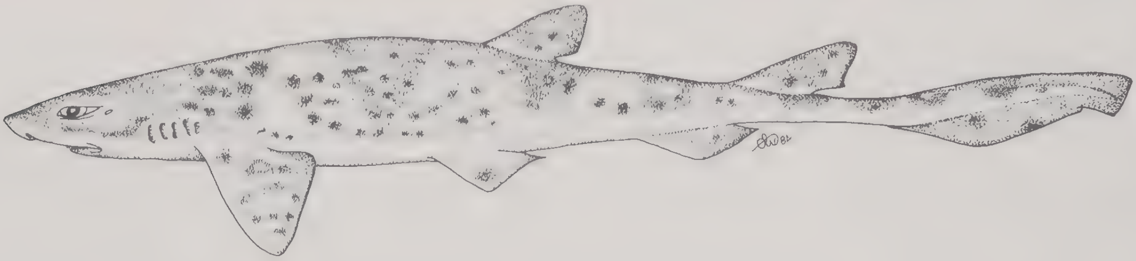
SCYL Schroed 1

Scyllium bivium Smith, 1837, Proc.Zool.Soc.Lond., 5:85 (nomen nudum); Smith, 1838, Ann.Mag.Nat.Hist., 1(1):73 (nomen nudum); Smith in Müller & Henle, 1838, Syst.Beschr.Plagiost., (pt. 1):8. Holotype: British Museum, Natural History, BMNH 1857.10.20, ca. 690 mm dried specimen. Type Locality: "Cape of Good Hope" (possibly near Cape Horn; see Springer, 1979:118).

Synonymy : None.

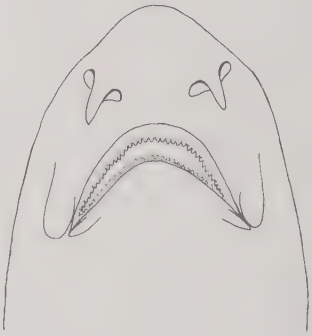
Other Scientific Names Recently in Use : Halaelurus bivius (Smith, in Müller & Henle, 1838).

FAO Names : En - Narrowmouthed catshark; Fr - Holbiche blanche; Sp - Pejegato bocachica.



Field Marks : A Schroederichthys with moderately slim body, narrow snout, and few large dark and small white spots.

Diagnostic Features : Trunk and tail fairly slender in adults but extremely attenuated in young. Snout narrowly rounded; anterior nasal flaps narrow and lobate. Mouth relatively narrow and long, especially in adult males. Colour pattern of 7 or 8 dark brown saddles on grey-brown dorsal surface, also relatively few, scattered large dark and small white spots, the dark spots not bordering the saddles. Adults to at least 70 cm.



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Geographical Distribution : Western South Atlantic and eastern South Pacific, Argentina south to Straits of Magellan and north to central Chile.

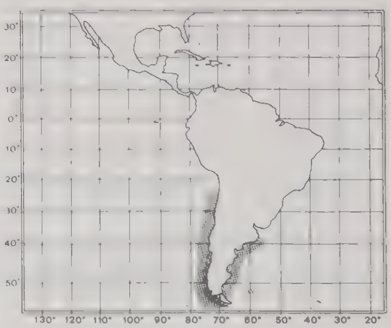
Habitat and Biology : A common inshore and offshore shark of the temperate South American continental shelf, found at depths of 14 to 78 m. Oviparous, probably with one egg per oviduct laid at a time. Sexual heterodonty, or dental sexual dimorphism, is strongly developed in this species, with adult males having teeth at least twice as high as comparably sized adult females as well as much longer and narrower mouths.

Size : Maximum about 70 cm; males maturing at about 53 cm; females at 40 cm.

Interest to Fisheries : Unknown.

Literature : Springer (1966, 1979); Gosztonyi (1973).

Remarks : Springer (1966, 1979) indicated that the type locality of this species, the Cape of Good Hope, is erroneous and suggested that it may have resulted either from transport of the stuffed holotype aboard a ship from South America to South Africa, or from a labelling error.



Schroederichthys chilensis (Guichenot, 1848)

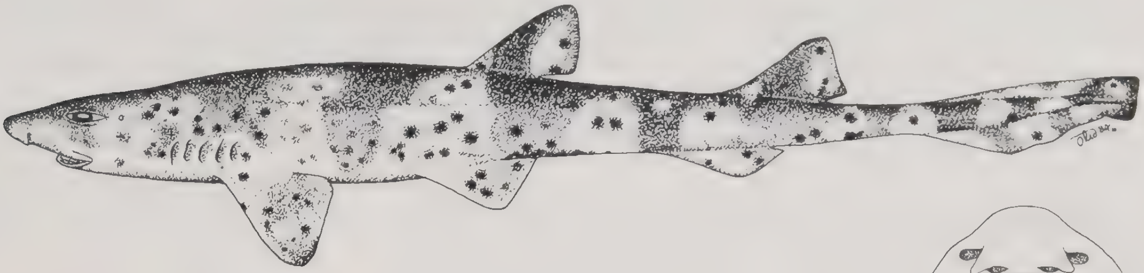
SCYL Schroed 2

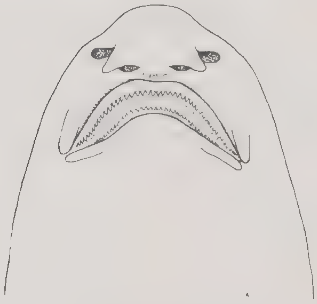
Scyllium chilense Guichenot, in Gay, 1848, Hist.Fis.Polit.Chile, Paris, Zool., 2:362. Holotype: ?. Type Locality: Chile.

Synonymy : ? Scyllium brevicolle Philippi, 1887.

Other Scientific Names Recently in Use : Halaelurus chilensis (Guichenot, in Gay, 1848).

FAO Names : En - Redspotted catshark; Fr - Holbiche à taches rouges; Sp - Pintarroja chilena.



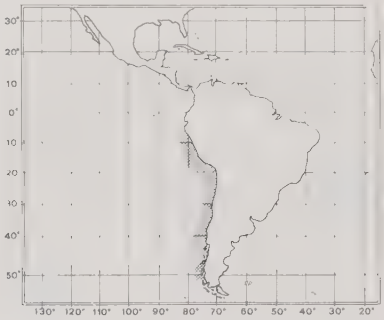


underside of head

Field Marks : A Schroederichthys with moderately slim body, broad snout and numerous black spots that do not border saddles.

Diagnostic Features : Trunk and tail fairly slender in adults. Snout more broadly rounded; anterior nasal flaps broad and triangular; mouth relatively broad and wide. Colour pattern of 6 to 9 brown to blackish saddles on light brown to dark grey or brownish-black dorsal surface, with numerous blackish spots scattered on dorsolateral surface and not bordering the saddles; white spots sometimes present. Adults to at least 63 cm.

Geographical Distribution : Eastern South Pacific: Peru and Chile.



Habitat and Biology : A common temperate inshore shark of the South American continental shelf, occurring on or near the bottom sometimes very close inshore in a few metres depth. Presumably oviparous.

Size : Maximum about 62 cm, adult males 56 to 62 cm.

Interest to Fisheries : Unknown.

Literature : Springer (1966, 1979); Kato, Springer & Wagner (1967).

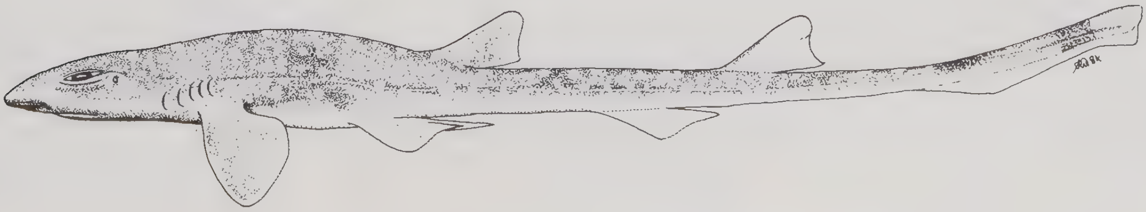
Schroederichthys maculatus Springer, 1966

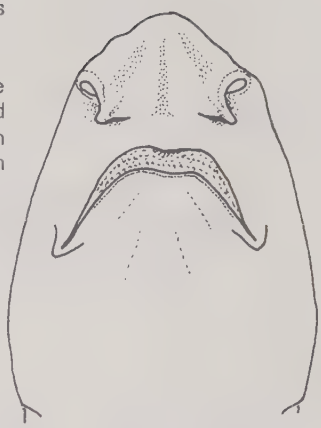
SCYL Schroed 3

Schroederichthys maculatus, Springer, 1966, Fish.Bull.U.S.Fish Wildl.Serv., 65(3):605, figs 4C, 5, 7P, 9C, 16A, 17, 19. Holotype: U.S. National Museum of Natural History, USNM-185556, 328 mm, adult male. Type Locality: Caribbean Sea NNW of Cape Gracias a Dios, Honduras, 16°39'N, 82°29'W, about 410 m depth.

Synonymy : None.

FAO Names : En - Narrowtail catshark; Fr - Holbiche petite queue; Sp - Pejegato rabo fino





Field Marks: A Schroederichthys with extremely slender body and white spots only.

Diagnostic Features: Trunk and tail extremely elongated in adults. Snout more broadly rounded; anterior nasal flaps broad and triangular; mouth relatively broad and wide. Colour pattern of 6 to 9 light brown saddles on back and tail, usually absent in adults, on tan to light grey dorsal surface, with numerous white spots scattered on dorsolateral surface and not bordering the saddles. Adults small, to about 35 cm.

Geographical Distribution: Western North Atlantic: Honduras and Nicaragua.

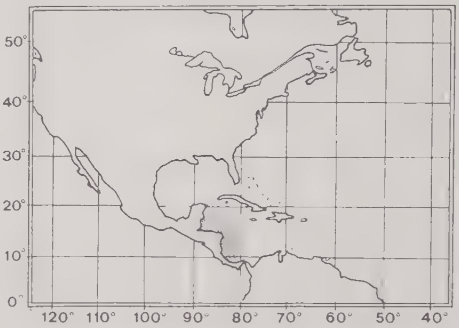
Habitat and Biology: A little-known deepwater tropical bottom catshark of the outer shelf and upper slope of Atlantic Central America, found at 190 to 410 m depth. It is thought to prefer bottom with fine white calcareous material. Oviparous, probably laying one egg per oviduct. Feeds on small bony fishes and cephalopods, with algae found in one specimen.

Size: Maximum 34 cm, adult males 28 to 33 cm, adult female 34 cm.

Interest to Fisheries: None at present.

Literature: Springer (1966, 1979).

Remarks: Springer (1979) noted that the attenuate proportions of adults of this species are very similar to those of its young. In contrast, the adults of the other three species of Schroederichthys are only moderately slender as adults, but the young at least of S. tenuis and S. bivius resemble all sizes of S. maculatus. This suggests that the present species is a pedomorphic dwarf, that has retained a juvenile morphology but becomes adult at a much smaller size than other Schroederichthys.



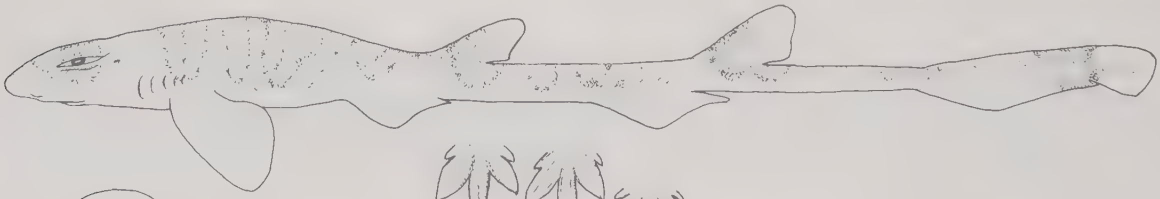
Schroederichthys tenuis Springer, 1966

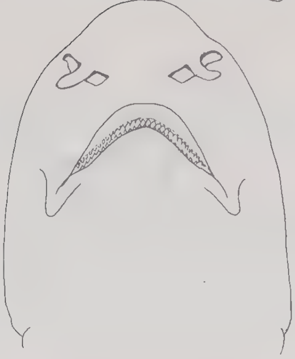
SCYL Schroed 4

Schroederichthys tenuis Springer, 1966, Fish.Bull.U.S.Fish Wildl.Serv., 65(3):606, figs 16B, 18. Holotype: U.S. National Museum of Natural History 188052, 230 mm, immature male. Type Locality: Off mouth of the Amazon River, Brazil, 01°49'N 46°48'W, in about 410 m depth.

Synonymy: None.

FAO Names: En - Slender catshark; Fr - Holbiche mannequin; Sp - Pejegato menudo.





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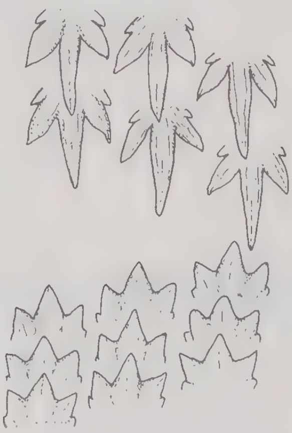
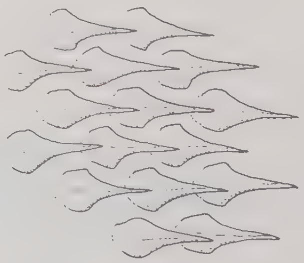


upper and lower teeth



dermal denticles

Field Marks : A Schroederichthys with fairly slender body (adults), broad snout and numerous small dark brown spots bordering saddles.

Diagnostic Features : Trunk and tail fairly slender in adults but extremely attenuated in young. Snout more broadly rounded; anterior nasal flaps narrow and lobate; mouth relatively broad and wide. Colour pattern of 7 or 8 brown saddles on light brown dorsal surface, with numerous small dark brown spots bordering saddles and scattered between them; no white spots. Adults to at least 70 cm.

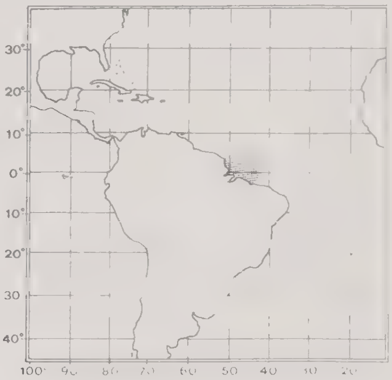
Geographical Distribution : Western Atlantic: Brazil (off Amazon River mouth).

Habitat and Biology : A little-known deepwater tropical catshark of the upper continental slope, found on or near the bottom at 410 m depth.

Size : Maximum 70 cm (adult).

Interest to Fisheries : None.

Literature : Springer (1966, 1979).



Scyliorhinus Blainville, 1816

SCYL Scyl

Genus : Subgenus Scyliorhinus Blainville, 1816 (Genus Squalus Linnaeus, 1758), Bull.Soc.Philomat.Paris, 8:121.

Type Species : "Scylliorhinus canicula Blainville", by subsequent designation of Gill (1862:407).

Synonymy : Subgenus Scyllium Cuvier, 1817 (Genus Squalus Linnaeus, 1758); Genus Scyllium Eichwald, 1819; Subgenus Scylliorhinus Blainville, 1825 (Genus Squalus Linnaeus, 1758); Genus Catulus Smith, 1837 (also Garman, 1913; junior homonym of Catulus Kniphof, 1759 in Insecta); "Pseudogenus" (= Subgenus) Alphascyllium Leigh-Sharpe, 1926 (Genus Scyllium Cuvier, 1817); "Pseudogenus" (= Subgenus) Betascyllium Leigh-Sharpe, 1926 (Genus Scyllium Cuvier, 1817); Genus Scylliorhynchus Nobre, 1935 (error); Genus Scylliorhynus Nobre, 1935 (error).

Field Marks : Scyliorhinids without trilobate, barbeled anterior nasal flaps, labial furrows on lower jaw only, second dorsal much smaller than first.

Diagnostic Features : Body not tadpole-shaped, moderately stout to slender and cylindrical or spindle-shaped, tapering considerably to caudal fin; body firm and thick skinned, with well-calcified dermal denticles; stomach not inflatable; tail moderately long, length from vent to lower caudal origin between 3/5 to 3/4 of snout-vent length. Head slightly to moderately depressed, narrowly rounded and not wedge-shaped in lateral view; head short, less than 1/5 of total length in adults; snout short, less than 3/4 of mouth width, thick, and slightly flattened, bluntly pointed in lateral view; snout not expanded laterally, rounded-parabolic in dorsoventral view; ampullal pores not greatly enlarged on snout; nostrils not enlarged to moderately enlarged, with incurrent and excurrent apertures only slightly open to exterior; anterior nasal flaps more or less triangular, sometimes slightly elongated, without a prominent barbel, well separated from each other and ending somewhat anterior to mouth but close together and reaching it in S. canicula; internarial space 0.3 to 0.8 times in nostril width; nasoral grooves usually absent except S. canicula in which broad grooves are present; eyes dorsolateral on head, broad subocular ridges present below eyes; mouth angular or broadly arched, moderately long, with lower symphysis somewhat behind upper so that upper teeth are well-exposed in ventral view (except S. canicula, in which upper teeth are obscured by lower jaw); labial furrows present along lower jaw only, these short to moderately long; vestigial uppers occasionally prsent; branchial region not greatly enlarged, distance from spiracles to fifth gill slits 1/2 to 2/5 head length; gill slits lateral on head. Two dorsal fins present, with the second considerably smaller than the first; origin of first dorsal varying from over last half of pelvic bases to over pelvic free rear tips; origin of second dorsal over last third of anal base to slightly behind anal insertion; pectoral fins large, their width about as great or considerably greater than mouth width. Inner margins of pelvic fins more or less fused over claspers in adult males, forming a 'apron'; claspers short, relatively thick, and distally pointed or rounded, extending less than half their lengths behind the pelvic fin tips; anal fin moderately large but not greatly elongated, subequal to pelvic and first dorsal fins but much larger than second dorsal, its base length 1.3 to 2.4 times the second dorsal base; origin of anal well behind pelvic bases, and insertion separated from lower caudal origin by a space varying from half as long to slightly longer than the anal base; caudal fin short and fairly broad, between 1/4 to 1/5 to less than 1/5 of total length in adults. No crests of denticles on the caudal margins; supraorbital crests present on cranium. Colour pattern extremely variable, ranging from simple dark saddles, reticulating dark bars, or large dark spots on a light background to combinations of light and dark spots and saddles.

Remarks : The arrangement of this genus follows Springer (1979), which in turn follows Springer's earlier treatments of the genus (Springer, 1966; Springer & Sadowsky, 1970).

Key to Species :

1a. Anterior nasal flaps greatly expanded and reaching mouth; shallow nasoral grooves present between nostrils and mouth .... **S. canicula**

1b. Anterior nasal flaps not greatly expanded and falling somewhat anterior to mouth; no nasoral grooves

2a. Colour pattern of black lines in a reticular pattern .... **S. retifer**

2b. Colour pattern variable, not in form of black lines in a reticular pattern

3a. Colour pattern includes numerous small light spots uniformly distributed on sides and back. Black spots few or absent

4a. A dwarf species, not exceeding 32 cm. Saddles obsolete in adults .... **S. torrei**

4b. A large species, exceeding 1 m. Saddles well developed in adults .... **S. capensis**

3b. Colour pattern variable, but with light spots, if present, confined to head, fins, or saddle marks, or combined with dark spots

5a. Saddle marks inconspicuous or masked by spots

6a. Small and large dark and sometimes white spots densely distributed over fins and body .... **S. stellaris**

6b. Large dark spots sparsely distributed on fins and body

7a. Round dark brown spots on fins and body .... **S. garmani**

7b. Irregular black spots on fins and body .... **S. besnardi**

5b. Saddle marks conspicuous

8a. Numerous white spots present but confined to saddle marks .... **S. hesperius**

8b. Usually no white spots, but few and not confined to saddle marks when present

9a. Saddle marks outlined by borders of black spots or broken black lines .... **S. boa**

9b. Saddle marks not outlined by black spots or lines

10a. Ground colour dark with darker saddles but spots few or absent

11a. Head broad, its width nearly equal to head length. Dorsolateral denticles lanceolate and small, skin not very rough .... **S. meadi**

11b. Head fairly narrow, width about 3/4 of head length. Dorsolateral denticles tricuspidate and large, skin very rough .... **S. torazame**

10b. Ground colour light with slightly darker saddles and numerous black spots

12a. Anal base as long as or longer than interdorsal space .... **S. cervigoni**

12b. Anal base shorter than interdorsal space .... **S. haeckelii**

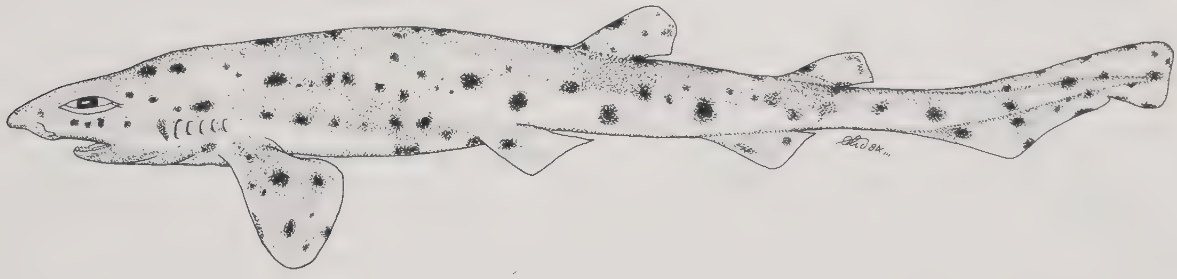
Scyliorhinus besnardi Springer & Sadowsky, 1970

SCYL Scyl 3

Scyliorhinus retifer besnardi Springer & Sadowsky, 1970, Proc.Biol.Soc.Wash., 83(7):95, fig. 2. Holotype: U.S. National Museum of Natural History, USNM 204376, 385 mm female. Type Locality: 33°26'S, 51°21'W, off Uruguay, western South Atlantic, 190 m depth.

Synonymy : None.

FAO Names : En - Polkadot catshark; Fr - Roussette polka; Sp - Alitán de lunares.



Field Marks : A fairly small and slender catshark with scattered, small to large, wide-spaced round black spots on sides and back but no saddles, with small anterior nasal flaps that end in front of mouth, no nasoral grooves, labial furrows on lower jaw only, and second dorsal fin much smaller than first.

Diagnostic Features : Head and body relatively deep, slender and fairly narrow; greatest width of head about 2/3 of head length; no nasoral grooves; anterior nasal flaps not expanded and falling short of mouth. First dorsal origin slightly behind pelvic insertions; second dorsal origin over last half of pelvic bases; interdorsal space greater than anal base. Denticles fairly large and erect, skin relatively rough. Colour pattern of sparse, wide-spaced, nearly round black spots, varying from smaller to much larger than eye pupil, sometimes with light centres; no white spots or prominent saddles. Size apparently small, to 47 cm.

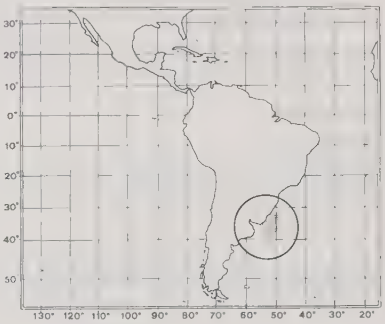
Geographical Distribution : Western South Atlantic: Northern Uruguay.

Habitat and Biology : A little-known bottom-dwelling shark found on the outer continental shelf at 140 to 190 m depth.

Size : Maximum 47 cm (adult males).

Interest to Fisheries : None.

Literature : Springer & Sadowsky (1970); Springer (1979).



Scyliorhinus boa Goode & Bean, 1896

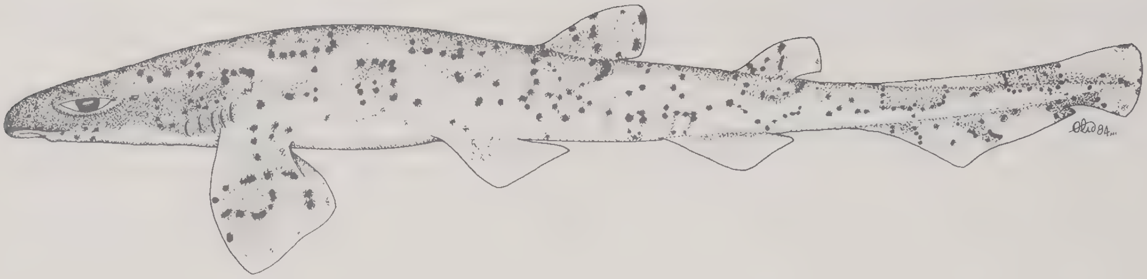
SCYL Scyl 4

Scylliorhinus boa Goode & Bean, 1896, Ocean.Ichthyol., Spec.Bull., 2, U.S.Nat.Mus., 17, pl. 2, fig. 6. Holotype: Museum of Comparative Zoology, Harvard, MCZ 1335, 150 mm immature male. Type Locality: Off Barbados, 366 m depth, western North Atlantic.

Synonymy : None.

Other Scientific Names Recently in Use : Scyliorhinus retifer boa Goode & Bean, 1896 (see Springer & Sadowsky, 1970).

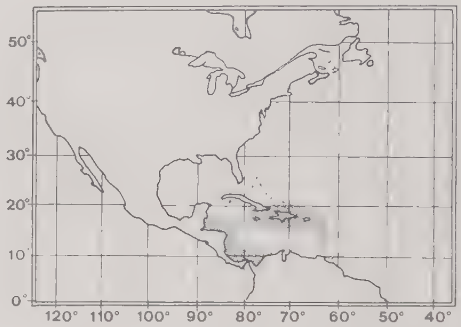
FAO Names : En - Boa catshark; Fr - Roussette boa; Sp - Alitán boa.



Field Marks: A moderate-sized, fairly slender catshark with rows of small black spots that outline inconspicuous saddle and flank markings but with few or no spots inside the saddles, fairly large and slender, small anterior nasal flaps that do not reach mouth, no nasoral grooves, labial furrows on lower jaw only, second dorsal fin much smaller than first.

Diagnostic Features: Head and body relatively deep, slender and narrow; greatest width of head less than 2/3 of head length; no nasoral grooves; anterior nasal flaps not expanded and falling short of mouth. First dorsal origin slightly behind pelvic insertions; second dorsal origin over last half of pelvic bases; interdorsal space greater than anal base. Denticles fairly small, skin not very rough. Colour pattern of numerous small black spots about size of eye pupil or more, forming rectilinear outlines to indistinct grey saddles and flank markings that hardly contrast with the ground colour; spots sometimes forming reticulating rows, but with few or none inside saddle areas; sometimes a few white spots on dorsolateral surface. Size fairly small, to at least 54 cm.

Geographical Distribution: Western North Atlantic: Caribbean Slope off Barbados, Lesser Antilles, Hispanola, Jamaica, and the continental slope from Honduras to Colombia.



Habitat and Biology: A little-known tropical deepwater catshark of the continental and insular slopes, on or near bottom, at 329 to 676 m depth. Presumably oviparous.

Size: Maximum at least 54 cm (adult male).

Interest to Fisheries: None at present.

Literature: Springer (1966, 1979); Springer & Sadowsky (1970).

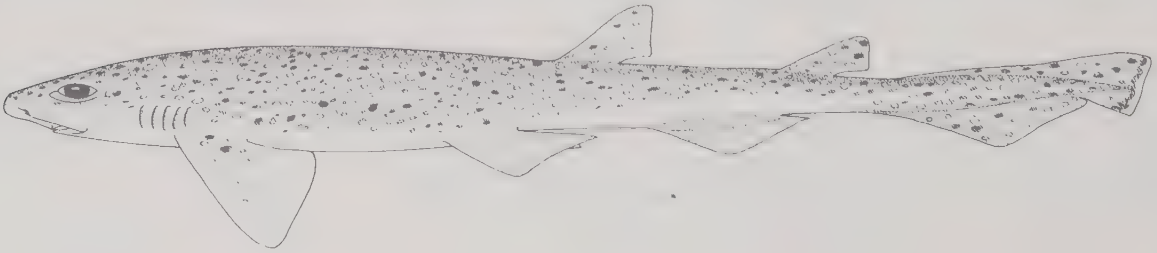
Scyliorhinus canicula (Linnaeus, 1758)

SCYL Scyl 1

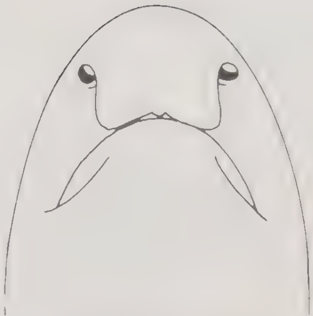
Squalus canicula Linnaeus, 1758, *Syst.Nat.*, ed. 10, 1:234. Holotype: Apparently none. Type Locality: "Habitat in Oceano Europae".

Synonymy: *Squalus catulus* Linnaeus, 1858; *Squalus elegans* Blainville, 1825; ? *Scyllium spinacipellitum* Vaillant, 1888; ? *Scyllium acutidens* Vaillant, 1888; *Scylliorhinus canicula* var. *albomaculata* Pietschmann, 1907; *Catulus duhamelii* Garman, 1913.

FAO Names: En - Small-spotted catshark; Fr - Petite roussette; Sp - Pintarroja.



Field Marks : A slender, dark-spotted catshark with greatly expanded anterior nasal flaps, reaching mouth and covering shallow nasoral grooves, labial furrows on lower jaw only, second dorsal fin much smaller than first.



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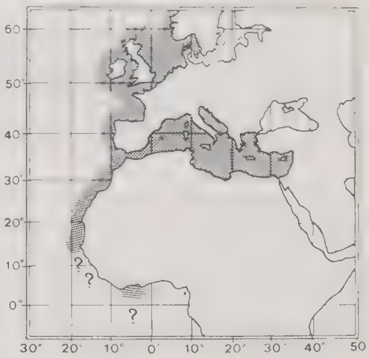
Diagnostic Features : Head and body relatively deep, slender and narrow; greatest width of head less than 2/3 of head length. Shallow nasoral grooves present between excurrent apertures of nostrils and mouth; anterior nasal flaps broadly expanded medially and posteriorly, nearly meeting each other medially and extending to the mouth. First dorsal origin well behind pelvic insertions; second dorsal origin over anal insertion. Interdorsal space slightly greater than anal base. Denticles small, skin not extremely rough. Colour pattern of numerous small dark spots, usually about size of eye pupil; 8 or 9 dusky saddle marks sometimes present but often obscure or obsolete; scattered white spots sometimes present. Size moderate, to 100 cm.

Geographical Distribution : Eastern North Atlantic: Norway and British Isles to Mediterranean, Senegal, ? Ivory Coast.



Habitat and Biology : An abundant temperate bottom-dwelling catshark of the European continental shelves and uppermost slopes, on sandy, coralline algal, gravel or mud bottoms at depths from a few metres commonly down to 110 m and exceptionally to 400 m; sometimes occurs in midwater. Young sharks and hatchlings are found in shoaler water than adults, which often occur in unisexual schools. On the spawning grounds adult females show up first in early winter and preponderate in numbers until early spring, when adult males join them. In late summer adults of both sexes move into deep water where mating occurs.

Oviparous, laying eggs one per oviduct at a time. Spawning occurs in shallow water, often in sandy areas; egg-cases are often deposited on algal substrates, mostly subtidally but sometimes in the lower intertidal, and hatch in 5 to 11 months (most in 8 to 9 months). Eggs may be laid all year in shallow water but most are deposited from November to July, with local populations apparently showing differences in deposition time. A single egg is laid per oviduct at a time. Eggs vary in size according to locality and size of female. In Mediteranean waters, with smaller females than the eastern Atlantic, egg-cases are about 4 cm long by 2 cm wide, while sharks off the United Kingdom lay eggs 5 to 7 by 2 to 3 cm.

Feeds mostly on molluscs and crustaceans, especially whelks but also other gastropods; scallops, razor clams and other bivalves; small cephalopods; and hermit and swimming crabs, lobsters, slipper lobsters, and shrimp. Also eats polychaete worms. This shark takes a variety of small, mostly bottom-dwelling bony fishes such as gurnards, flatfish, and gobies, but also takes herring and pilchard, small gadoids like whiting and pouting, jacks and mackeral.

Size : Maximum recorded about 100 cm (British Isles and North Sea), maximum and size at maturity less in Mediterranean than elsewhere; Mediterranean males mature at 39 cm and reach 60 cm, females mature at 44 cm and reach at least 60 cm; size at hatching 9 to 10 cm.

Interest to Fisheries : This is a moderately important commercial species in European waters, particularly around the British Isles. It is primarily taken by bottom trawls, but also fixed bottom nets and even pelagic trawls. It is utilized fresh and dried-salted for human consumption, also for oil and fishmeal.

Literature : Garman (1913); Tortonese (1956); Cadenat (1957); Wheeler (1969, 1978); Springer (1979); Compagno (1981).

Remarks : Several writers have pointed out that eastern Atlantic members of this species are considerably larger than Mediterranean sharks. Garman (1913) even went so far as to name a new species, Catulus duhameli, for Mediterranean canicula. This is generally not recognized by more recent writers, but still some populational differentiation of this shark apparently exists, which may eventually be expressed as subspecies.

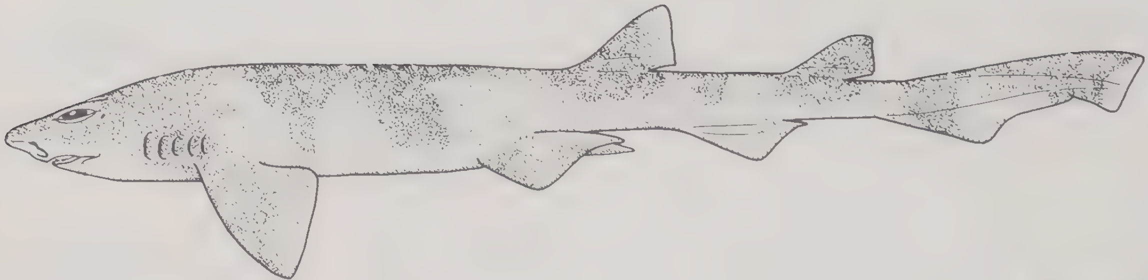
Scyliorhinus capensis (Smith, 1838)

SCYL Scyl 5

Scyllium capense Smith, 1837, Proc.Zool.Soc.Lond., 5:85 (nomen nudum); Smith, 1838, Ann.Mag.Nat.Hist., 1(1):73 (nomen nudum); Smith, in Müller & Henle, 1838, Syst.Beschr.Plagiost., pt. 1:11. Syntypes: Rijksmuseum van Natuurlijke Historie, Leiden, and British Museum (Natural History). Type Locality: Cape of Good Hope, South Africa.

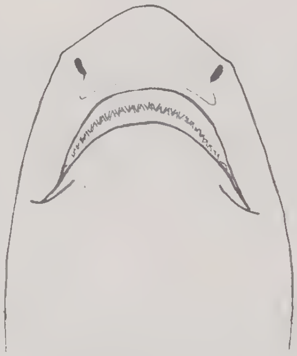
Synonymy : None.

FAO Names : En - Yellowspotted catshark; Fr - Roussette à taches jaunes; Sp - Alitán de manchas amarillas.



Field Marks : A fairly large and slender, bright yellow-spotted and grey-saddled catshark with small anterior nasal flaps that do not reach mouth, no nasoral grooves, labial furrows on lower jaw only, second dorsal fin much smaller than first.

Diagnostic Features : Head and body relatively deep, slender and narrow; greatest width of head less than 2/3 of head length; no nasoral grooves; anterior nasal flaps not expanded and falling just short of mouth. First dorsal origin somewhat behind pelvic insertions; second dorsal origin over pelvic insertions; interdorsal space somewhat greater than anal base. Denticles fairly large and erect, skin relatively rough. Colour pattern of numerous small bright yellow spots about size of eye pupil or more; 8 or 9 dusky grey saddle marks on back; no dark spots. Size large, to 1.2 m.



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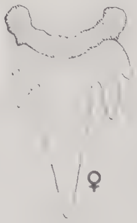
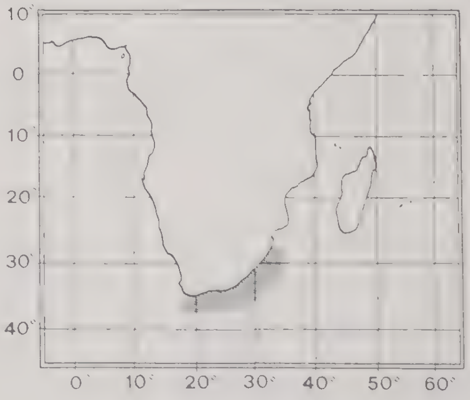


tooth

dermal denticle

Geographical Distribution : Eastern South Atlantic and western Indian Ocean: South Africa (southwestern Cape Province east to Natal).



Habitat and Biology : A common inshore to offshore temperate catshark on the Cape coast of South Africa, uncommon to rare norhwestward to Natal; depths recorded from 26 to 420 m, possibly deeper (420 m) off Natal than the south Cape (26 to 290 m) and perhaps showing tropical submergence.

Oviparous, laying one egg per oviduct at a time; egg cases about 8 cm long by 3 cm wide.

Feeds commonly on small bony fishes and crustaceans, also cephalopods.

Size : Maximum recorded 122 cm; males maturing between 66 and 78 cm and reaching at least 95 cm; females maturing between 68 and 70 cm and reaching over 85 cm; size at hatching below 30 to 31 cm (size of young with umbilical scars).

Interest to Fisheries : None at present, taken by commercial bottom trawls.

Literature : Fowler (1941); Smith (1949); Bass, D'Aubrey & Kistnasamy (1975); Springer (1979).

Remarks : This species has been recorded from India (Günther, 1870, Day, 1878; based on a stuffed specimen in the British Museum (Natural History)) and Pakistan (Quereshi, 1972). Bass, D'Aubrey & Kistnasamy (1975) noted that Day's (1878, fig. 190, no. 1) illustration of his Indian capensis differs from this species in its colour pattern and first dorsal position, and suggest that the Indian shark is a different (possibly undescribed) species. The writer, in a short trip to India in 1982, was unable to find any Scyliorhinus specimens in collections and in the field, but that hardly means that Indo-Pakistani Scyliorhinus do not exist.

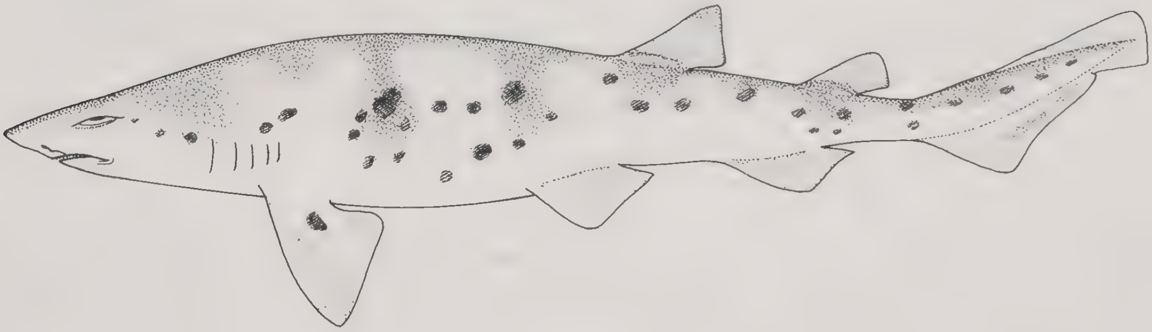
Scyliorhinus cervigoni Maurin & Bonnet, 1970

SCYL Scyl 6

Scylliorhinus cervigoni Maurin & Bonnet, 1970, Rev.Trav.ISTPM, Nantes, 34(2):5, fig. 3. Holotype: 380 mm female. Type Locality: Senegal, eastern North Atlantic.

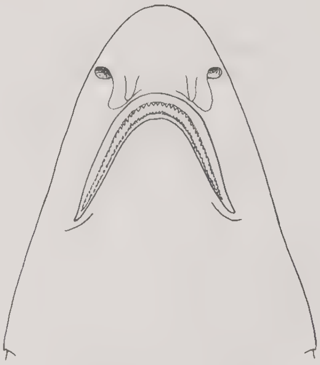
Synonymy : None.

FAO Names : En - West African catshark; Fr - Roussette thalassa; Sp - Alitán africano.



Field Marks : A fairly large, very stout catshark with relatively large, few, and scattered dark spots, dark saddles centred on dark spots on the midline of the back, and no white spots, small anterior nasal flaps that barely reach mouth, no nasoral grooves, labial furrows on lower jaw only, interdorsal space slightly less than anal base, second dorsal fin much smaller than first.

Diagnostic Features : Body very stout, head broad and fairly flat, greatest width of head at least 2/3 of head length; no nasoral grooves; anterior nasal flaps not expanded and just reaching mouth. First dorsal origin slightly behind pelvic insertions; second dorsal origin over last third of pelvic bases; interdorsal space somewhat less than anal base. Denticles fairly large and erect, skin relatively rough. Colour pattern of scattered large and some small dark spots along body, 8 or 9 dusky saddle marks centred on dark spots on midback; no light spots. Size large, probably over 80 cm.



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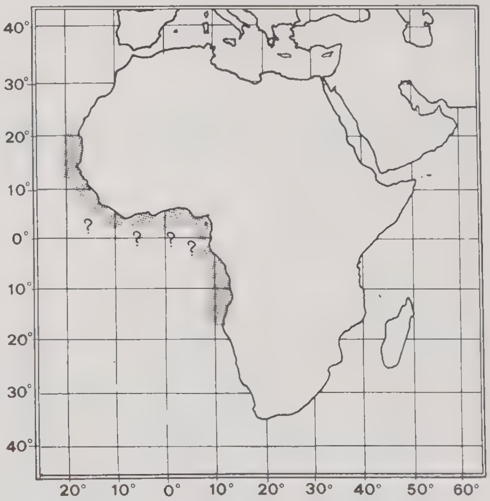
Geographical Distribution : Eastern Atlantic: Probably wide-ranging off tropical West Africa, from Mauritania to Angola; records include Mauritania, Senegal, possibly Gambia to Guinea, possibly Liberia, possibly Gabon to Zaire, and Angola.



Habitat and Biology : A little-known tropical bottom-dwelling catshark of the continental shelf and upper slope, at depths of 45 to 500 m, on rocky and mud bottom; observed temperatures where caught, 11 to 16°C; salinity, 36°/oo; oxygen, 1.0 to 1.6 ml/l. Probably oviparous, egg-cases thought to be from this species were about 7 to 8 cm long by about 3 cm wide. Eats bony fish. May replace S. stellaris off tropical West Africa.

Size : Maximum about 76 cm; adolescent male 64 cm, adult male 67 cm; females to at least 76 cm.

Interest to Fisheries : Uncertain, probably taken by offshore trawling fleets off West Africa, but because this species has been confused with S. stellaris in the past fisheries data for it has probably been reported under stellaris.

Literature : Poll (1951); Maurin & Bonnet (1970); Springer (1979).

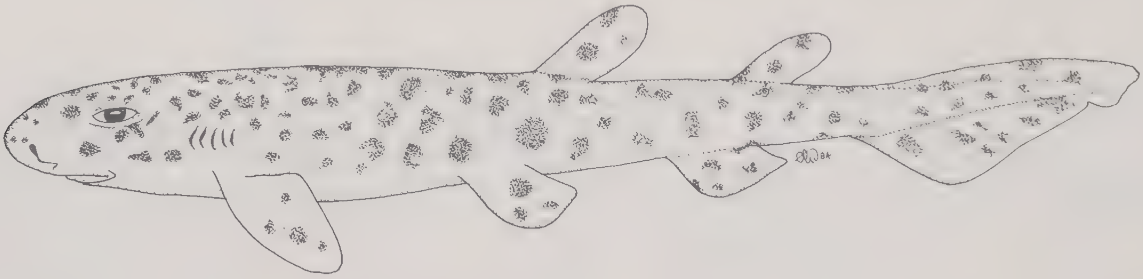
Scyliorhinus garmani (Fowler, 1934)

SCYL Scyl 7

Halaelurus garmani Fowler, 1934, Proc.Acad.Nat.Sci.Philad., 85:235, fig. 1. Holotype: U.S. National Museum USNM 43749, 240 mm female. Type Locality: "East Indies".

Synonymy : None.

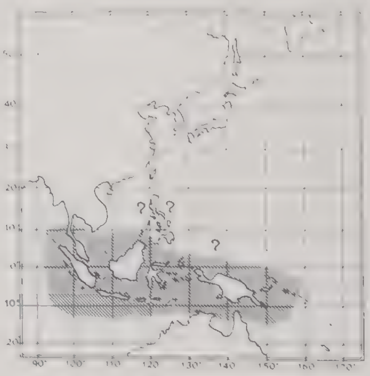
FAO Names : En - Brownspotted catshark; Fr - Roussette à taches brunes; Sp - Alitán manchado.



Field Marks : A stocky catshark with large round brown spots scattered on body, indistinct saddle markings, no white spots, anterior nasal flaps not reaching mouth, no nasoral grooves, labial furrows on lower jaw only, second dorsal fin much smaller than first.

Diagnostic Features : Body relatively stout but head deep and narrow. Greatest width of head less than 2/3 of head length; no nasoral grooves; anterior nasal flaps moderately expanded medially and posteriorly, well separated medially but extending to the mouth. First dorsal origin about opposite pelvic insertions; second dorsal origin over last third of pelvic bases; interdorsal space somewhat greater than anal base. Denticles rather large and erect crowned, skin fairly rough. Colour pattern of large scattered brown spots as large or larger than eye pupil; 7 dusky saddle marks obscure or obsolete; no white spots. Adult size unknown, maximum size over 24 to 36 cm.

Geographical Distribution : Indo-West Pacific: "East Indies" (Fowler, 1934), possibly the Philippines (Herre, 1953).



Habitat and Biology : Unknown.

Size : Maximum 24 or 36+ cm; adult size unknown.

Interest to Fisheries : None.

Literature : Fowler (1934, 1941); Herre (1953); Talwar (1974); Springer (1979).

Remarks : Fowler (1934, 1941) placed this species in Halaelurus, but reexamination of its holotype by Springer (1979) indicated that it belongs in the genus Scyliorhinus (confirmed by the writer, who also examined the holotype).

Scyliorhinus haeckeli (Ribeiro, 1907)

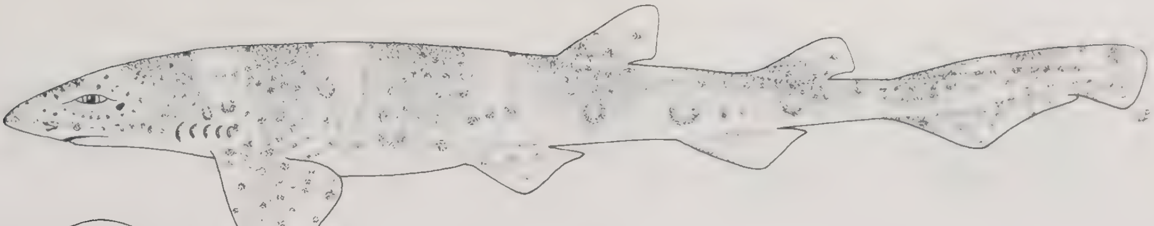
SCYL Scyl 8

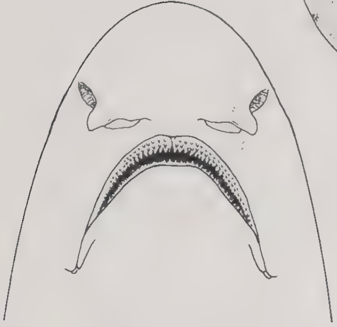
Catulus haeckelii Ribeiro, 1907, Arch.Mus.Nac.Rio de Janeiro, 14:163, pl. 8. Holotype: Museo Nacional, Rio de Janeiro, Brazil, MNB 494, 316 mm immature male. Type Locality: Western South Atlantic, off Ilha Rasa, near Rio de Janeiro, Brazil, 80 m depth.

Synonymy : Scyliorhinus fernandezi Weibezahn, 1953.

Other Scientific Names Recently in Use : Scyliorhinus retifer haeckelii (Ribeiro, 1907) (see Springer & Sadowsky, 1970).

FAO Names : En - Freckled catshark; Fr - Roussette taches de son; Sp - Alitán pecoso.





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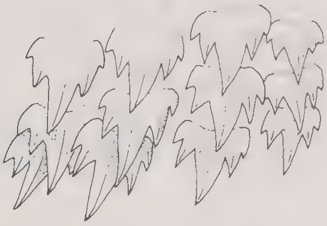
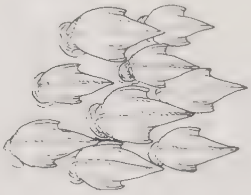


upper teeth



dermal denticles

Field Marks : A small, slender, dark-saddled catshark with very small black spots outlining saddles and generally covering dorsal surface, small anterior nasal flaps that do not reach mouth, no nasoral grooves, labial furrows on lower jaw only, second dorsal fin much smaller than first.

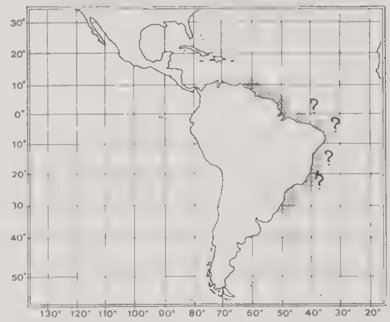
Diagnostic Features : Head and body relatively deep, slender and narrow; greatest width of head about 2/3 of head length; no nasoral grooves; anterior nasal flaps not expanded and falling just short of mouth. First dorsal origin somewhat behind pelvic insertions; second dorsal origin somewhat anterior to anal insertion; interdorsal space slightly greater than anal base. Denticles small and flat, surface of skin relatively smooth. Colour pattern of 7 or 8 dusky and sometimes obscure saddles, outlined by very small black spots which are also generally scattered over the dorsal surface; no light spots. Size small, adults below 40 cm.

Geographical Distribution : Western Atlantic: Western Venezuela, Surinam, Brazil, Uruguay.

Habitat and Biology : A little-known tropical Atlantic South American catshark of the continental shelf and upper slope, on or near bottom, at depths of 37 to 402 m. Oviparous, deposits eggs in cases 6 to 7 cm long and 2 to 3 cm wide, which have been trawled on coral and sea-fan covered bottom.

Size : To at least 35 cm (adult male); hatchling young 10 to 13 cm long.

Interest to Fisheries : None at present.



Literature : Bigelow & Schroeder (1948); Springer & Sadowsky (1970); Springer (1979).

Remarks : This catshark was synonymized with S. boa by Bigelow & Schroeder (1948), considered a subspecies of S. retifer by Springer & Sadowsky (1970), but later resurrected as a full species by Springer (1979).

Scyliorhinus hesperius Springer, 1966

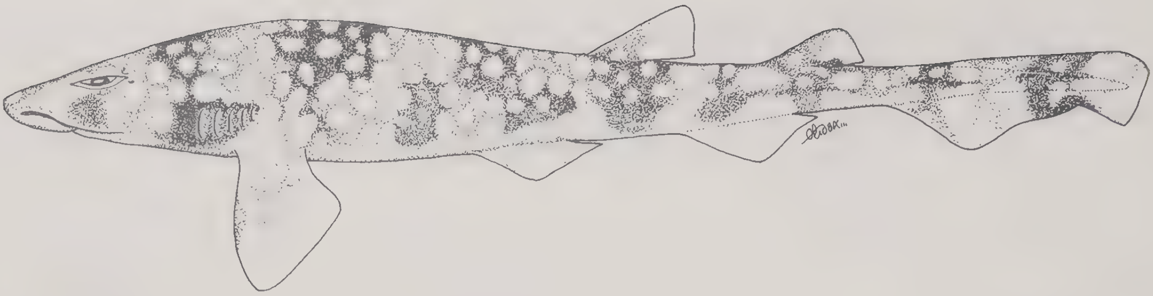
SCYL Scyl 9

Scyliorhinus hesperius Springer, 1966, Fish.Bull.U.S.Fish Wildl.Serv., 65(3):603, figs 7D, 9A, 15A, 27D. Holotype: U.S. National Museum, USNM 187732, 415 mm immature female. Type Locality: Western North Atlantic, Caribbean coast of Panama, 09°03'N, 81°22'W, from 360 to 400 m depth.

Synonymy : None.

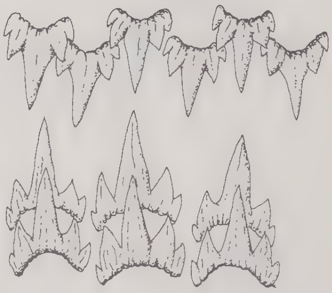
Other Scientific Names Recently in Use : Scyliorhinus retifer boa Goode & Bean, 1896 (see Springer & Sadowsky, 1970).

FAO Names : En - Whitesaddled catshark; Fr - Roussette selle blanche; Sp - Alitán ensillado.



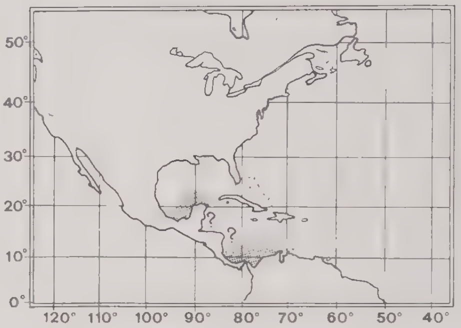
Field Marks: A fairly small, slender, dark-saddled catshark with large, white spots covering saddles but usually with light spaces between saddles, no black spots, small anterior nasal flaps that end in front of mouth, no nasoral grooves, labial furrows on lower jaw only, second dorsal fin much smaller than first.

Diagnostic Features: Head and body relatively deep, slender and narrow; greatest width of head about 2/3 of head length; no nasoral grooves; anterior nasal flaps not expanded and falling just short of mouth. First dorsal origin somewhat behind pelvic insertion; second dorsal origin somewhat anterior to anal insertion; interdorsal space slightly greater or slightly less than anal base. Denticles small and flat, surface of skin relatively smooth. Colour pattern of 7 or 8 dusky saddles densely covered with large light spots at least as large as eye pupil, these sometimes extending to spaces between saddles; no black spots. Size moderate, adults below 50 cm.



upper and lower teeth

Geographical Distribution: Western North Atlantic: Honduras, ?Panama, Colombia.



Habitat and Biology: An uncommon deepwater tropical catshark of the upper continental slope of Atlantic Central America, on or near bottom, at depths of 274 to 457 m.

Size: Maximum at least 47 cm (adult female).

Interest to Fisheries: None at present.

Literature: Springer (1966, 1979); Springer & Sadowsky (1970).

Remarks: This species was synonymized with S. retifer by Springer & Sadowsky (1970), and included under S. retifer boa, but was resurrected as a full species by Springer (1979).

Scyliorhinus meadi Springer, 1966

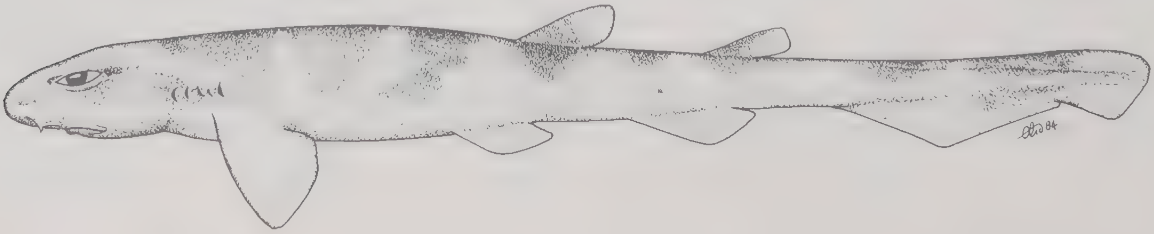
SCYL Scyl 10

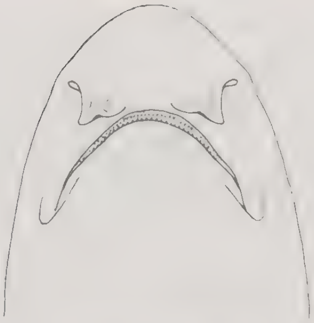
Scyliorhinus meadi Springer, 1966, Fish.Bull.U.S.Fish Wildl.Serv., 65(3):600, figs 3, 7A, 14B, 27C. Holotype: U.S. National Museum, USNM 188049, 247 mm immature male. Type Locality: Western North Atlantic, off Cape Canaveral, Florida, USA, 28°21'N, 78°51'W, 329 m depth.

Synonymy: None.

Other Scientific Names Recently in Use: Scyliorhinus retifer meadi Springer, 1966 (see Springer & Sadowsky, 1970).

FAO Names: En - Blotched catshark; Fr - Roussette cloquée; Sp - Alitán pintarrajo.





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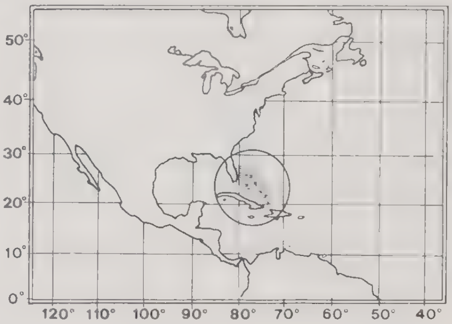
Field Marks : A fairly large, stocky dark-saddled catshark without spots, small anterior nasal flaps that end just in front of mouth, no nasoral grooves, labial furrows on lower jaw only, second dorsal fin much smaller than first.

Diagnostic Features : Head and body relatively broad and wide, greatest width of head about equal to head length; no nasoral grooves; anterior nasal flaps not expanded and falling just short of mouth. First dorsal origin opposite or somewhat anterior to pelvic insertions; second dorsal origin somewhat anterior to anal insertion; interdorsal space slightly greater than anal base. Denticles moderate-sized and flat, skin surface relatively smooth. Colour pattern of 7 or 8 dusky and sometimes obscure saddles, without black or light spots. Size probably large, immature male 49 cm.

Geographical Distribution : Western North Atlantic: North Carolina south to Florida, USA, and Santaren Channel between Cuba and Bahamas Bank.



Habitat and Biology : A rare, heavy-bodied deepwater tropical-subtropical catshark of the continental slope, on or near the bottom at 329 to 548 m depth. Its biology is almost totally unknown.

Size : Maximum at least 49 cm (immature specimen).

Interest to Fisheries : None at present.

Literature : Springer (1966, 1979); Springer & Sadowsky (1970).

Remarks : This species was reduced to a subspecies of S. retifer by Springer & Sadowsky (1970), but later resurrected by Springer (1979) after new material suggested that his earlier action of considering it a full species (Springer, 1966) was correct.

Scyliorhinus retifer (Garman, 1881)

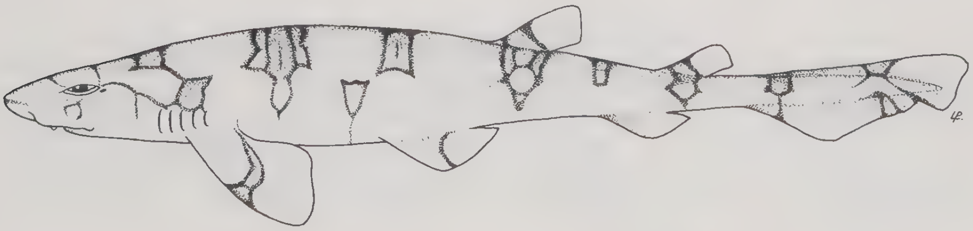
SCYL Scyl 11

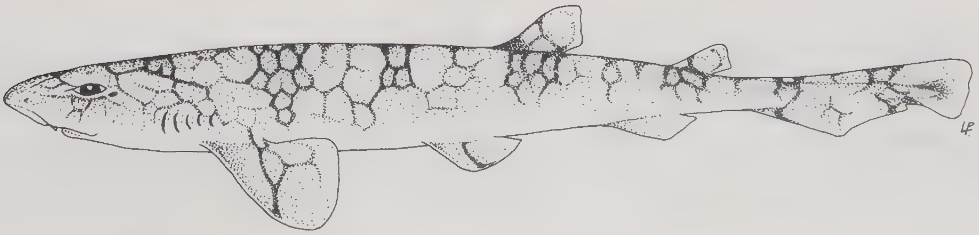
Scyllium retiferum Garman, 1881, Bull.Mus.Comp.Zool.Harv.Coll., 8(11):233. Holotype: Museum of Comparative Zoology, Harvard, MCZ-825, 307 mm immature male. Type Locality: Off Virginia, USA, 38°22.6'N, 73°33.7'W, 163 m depth.

Synonymy : None.

Other Scientific Names Recently in Use : Scyliorhinus retifer retifer (Garman, 1881) (see Springer & Sadowsky, 1970).

FAO Names : En - Chain catshark; Fr - Roussette maille; Sp - Alitán mallero.

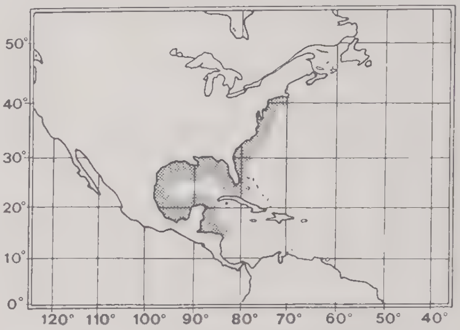




Field Marks: The bold chain colour pattern of black lines is unique to this shark and Cephaloscyllium fasciatum; but the latter species has no labial furrows and more anteriorly situated dorsal fins.

Diagnostic Features: Head and body relatively deep, slender and narrow; greatest width of head about 2/3 of head length; no nasoral grooves; anterior nasal flaps not expanded and falling somewhat anterior to mouth. First dorsal origin somewhat behind pelvic insertions; second dorsal origin somewhat anterior to anal insertion; interdorsal space considerably greater than anal base. Denticles small and flat, surface of skin relatively smooth. Colour pattern of bold black lines, outlining obscure dusky saddles and sometimes extending over lateral surfaces and back as a reticular network; no light or dark spots. Size moderate, adults below 50 cm.

Geographical Distribution: Western North Atlantic: Southern New England to Florida, northern Gulf of Mexico to Nicaragua.



Habitat and Biology: A common deepwater catshark of the outer continental shelf and upper slope, found on or near the bottom, at depths of 73 to 550 m. At the northern end of its range it occurs on the outer continental shelf but southward it is a slope species generally found below 450 m. Its distribution is irregular, with areas where it is common being interspersed with those where it is rare or absent. There is some evidence that it is commonest on extremely rough, rocky bottom where trawl hauls are difficult or impossible to make. Water temperatures where it occurs range from 8.5 to 11.3°C.

Oviparous. A trawl haul of numerous hatchlings off Cape Hatteras, North Carolina, USA, suggests that there is a limited 'nesting' and nursery area there.

Food habits are unknown. All of 38 adults and young examined by Springer (1979) were empty of food, but half of these had small pebbles in their stomachs; Springer hypothesized that these might be useful as ballast.

Size: Maximum 47 cm, adult males 37 to 41 cm, adult females 35 to 47 cm; size of hatchlings about 10 cm.

Interest to Fisheries: None at present.

Literature: Bigelow & Schroeder (1948); Springer (1966, 1979); Springer & Sadowsky (1970).

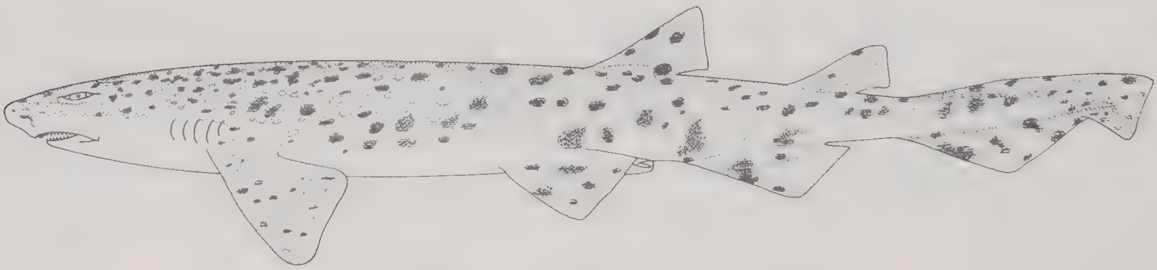
Scyliorhinus stellaris (Linnaeus, 1758)

SCYL Scyl 2

Squalus stellaris Linnaeus, 1758, Syst.Nat., ed. 10, 1:235. Holotype: None. Type Locality: European seas.

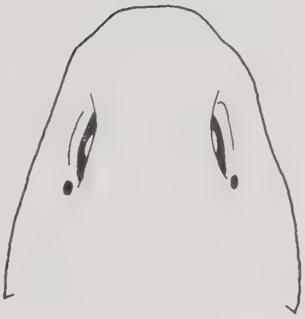
Synonymy: ? Scyllium acanthonotum Filippi & Verany, 1853

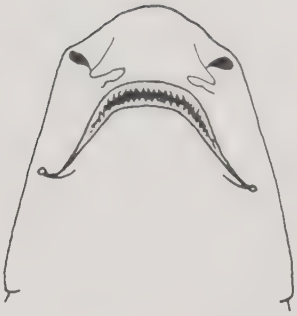
FAO Names: En - Nursehound; Fr - Grande roussette; Sp - Alitán.



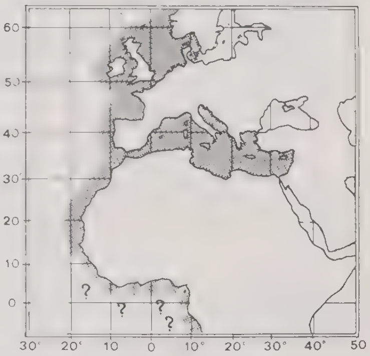
Field Marks: A large, fairly stocky, catshark with large and small black spots and sometimes white spots covering dorsal surface, saddle markings obsolete, small anterior nasal flaps that do not reach mouth, no nasoral grooves, labial furrows on lower jaw only, second dorsal fin much smaller than first.

Diagnostic Features: Head and body moderately broad. Greatest width of head about 2/3 of head length; no nasoral grooves; anterior nasal flaps not expanded and falling just short of mouth. First dorsal origin opposite pelvic insertions; second dorsal origin well anterior to anal insertion; interdorsal space subequal or less than anal base. Denticles fairly large and semierect, surface of skin relatively rough. Colour pattern of numerous small and large black spots sometimes interspersed with white spots, the large spots often irregular, subangular, and sometimes expanded into large blotches that may totally cover the body in some individuals; saddle markings indistinct or absent. Size large, adults to 1.6 m.


dorsal view of head


underside of head

Geographical Distribution: Eastern North Atlantic: Southern Scandinavia and British Isles to Mediterranean, Morocco, Senegal, ? Gambia to Guinea, ? Liberia, ? Gabon to Zaire (tropical West African records = S. cervigoni ?).



Habitat and Biology: A common inshore and offshore shark of the eastern Atlantic continental shelf, but less abundant than S. canicula; found at depths of 1 or 2 m to at least 125 m, but commonest in depths of 20 to 63 m. It often occurs on rough or even rocky bottom or that with algal cover. In the Mediterranean, it is apparently fond of coralline algal bottom.

Oviparous, with a single egg laid at a time per oviduct. The large thick-walled egg-cases, 10 to 13 cm long and with strong tendrils at each corner, are deposited on algae in the subtidal or extreme lower intertidal in spring and summer and may take 9 months to hatch.

Eats mostly crustaceans, including hermit crabs, swimming crabs, cancrid crabs, and large shrimp, squid, octopi and other molluscs, a variety of bony fish including mackeral, epigonids, dragonets, gurnards, flatfish, herring, and small codfish and other bottom fishes, and other sharks (Scyliorhinus canicula).

Size: Maximum to 162 cm; adults common to 125 cm, size at hatching about 16 cm.

Interest to Fisheries: In European waters less important as a fisheries species than S. canicula, but regularly taken in bottom trawls and fixed bottom nets, and occasionally pelagic trawls. It is utilized fresh and dried salted for human consumption, and made into fishmeal.

Literature: Cadenat (1957); Tortonese (1963); Wheeler (1969, 1978); Springer (1979).

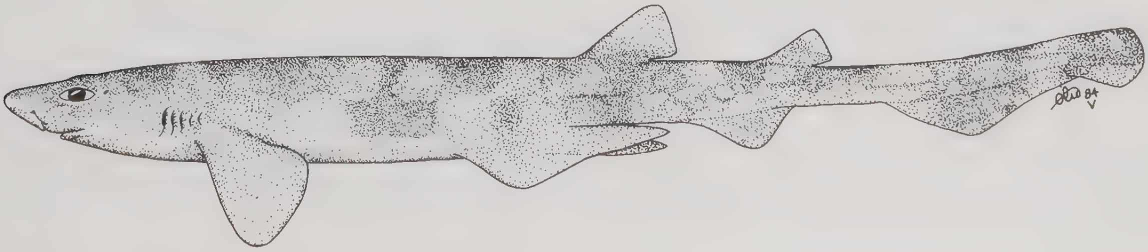
Scyliorhinus torazame (Tanaka, 1908)

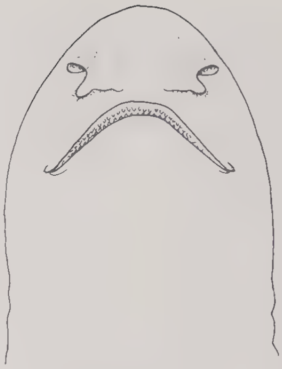
SCYL Scyl 12

Catulus torazame Tanaka, 1908, J.Coll.Sci.Imp.Univ.Tokyo, 23(7):6, pl. 2, fig. 2. Holotype: Zoological Institute, Science College, Imperial University of Tokyo, no. 953, ca. 449 mm adult male. Type Locality: Misaki, Sagami Province, Japan.

Synonymy: Scylliorhinus rudis Pietschmann, 1908.

FAO Names: En - Cloudy catshark; Fr - Roussette nuageuse; Sp - Alitán nubarrado.

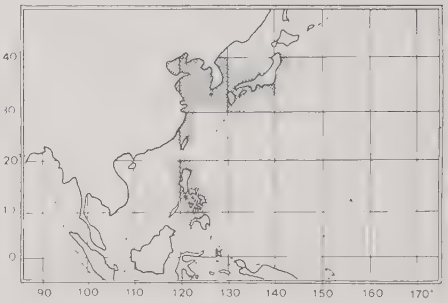




underside of head

Field Marks : A fairly small, slender, dark-saddled catshark with or without scattered large irregular dark and light spots, very rough skin, small anterior nasal flaps that do not reach mouth, no nasoral grooves, labial furrows on lower jaw only, second dorsal fin much smaller than first.

Diagnostic Features : Head and body relatively deep, slender and narrow. Greatest width of head about 2/3 of head length; no nasoral grooves; anterior nasal flaps not expanded and falling in front of mouth. First dorsal origin about opposite pelvic insertions; second dorsal origin well anterior to anal insertion; interdorsal space considerably greater than anal base; claspers with a row of strongly differentiated hooks on exorhipidion. Denticles large and erect, surface of skin very rough. Colour pattern of 6 to 9 obscure dusky saddles, interspersed in larger specimens by many irregular large dark and light spots. Monospondylous precaudal centra 33 to 38. Size moderate, adults below 50 cm.



Geographical Distribution : Western North Pacific: Japan, Korea, China, and the Philippines.

Habitat and Biology : A common catshark of the western Pacific continental shelf, from close inshore down to at least 100 m depth. In Japanese waters the species seems to be a year-round resident, with little seasonal migration.

Oviparous, with only one egg laid per oviduct at a time, and with most of the embryonic development occurring after the egg is laid. Egg-cases about 2 by 6 cm long, deposited in a definite nursery or hatching ground.

Size : Maximum about 48 cm, adult males 41 to 48 cm, adult females 39 + cm, size at hatching 8 + cm.

Interest to Fisheries : Unknown.

Literature : Fowler (1941); Nakaya (1975); Springer (1979).

Remarks : Springer (1979) questioned the validity of Nakaya's (1975) listing of this shark from the Philippines.

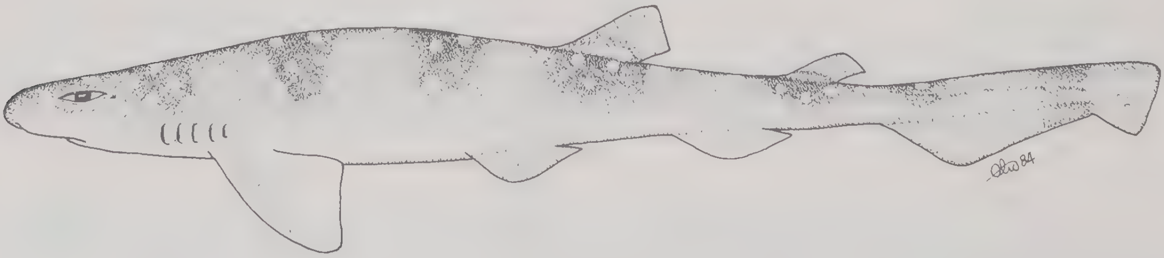
Scyliorhinus torrei Howell-Rivero, 1936

SCYL Scyl 13

Scylliorhinus torrei Howell-Rivero, 1936, Proc.Boston Soc.Nat.Hist., 41:43, pl 9. Holotype: Museum of Comparative Zoology, Harvard, MCZ 1457, 250 mm female. Type Locality: Off Havana, Cuba.

Synonymy : Catulus boae Sanchez-Roig, 1931 (not Scyliorhinus boa).

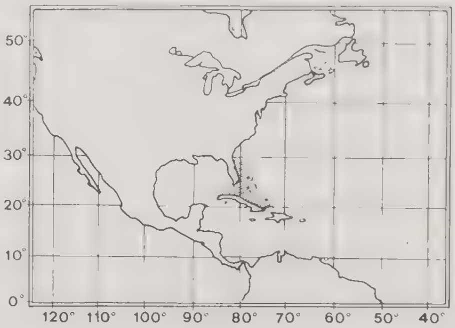
FAO Names : En - Dwarf catshark; Fr - Roussette naine; Sp - Alitán enano.



Field Marks : A dwarf, slender, brown and obscurely-saddled catshark with large white spots uniformly covering dorsal surface, small anterior nasal flaps that do not reach mouth, no nasoral grooves, labial furrows on lower jaw only, second dorsal fin much smaller than first.

Diagnostic Features: Head and body relatively deep, slender and narrow. Greatest width of head about 2/3 of head length; no nasoral grooves; anterior nasal flaps not expanded and falling just short of mouth. First dorsal origin opposite or somewhat behind pelvic insertions; second dorsal origin opposite or behind anal insertion; interdorsal space considerably greater than anal base; claspers without hooks on exorhipidion. Denticles small and flat, surface of skin relatively smooth. Colour pattern of 7 or 8 brown, obscure saddles on a light brown background and numerous large, regularly scattered white spots on dorsal surface; no black spots. Monospondylous precaudal centra 30 to 34. A dwarf species, adults 32 cm and below.

Geographical Distribution: Western North Atlantic: Southern Florida, USA, Bahamas, northern Cuba.



Habitat and Biology: An uncommon tropical, deepwater catshark, very localized in distribution, of the upper continental slope of the Florida Straits-Bahamas region; on or near the bottom at depths of 229 to 550 m, with most below 366 m. Biology little-known, eggs and hatchling young unknown.

Size: Maximum about 32 cm, adult males from 24 to 26 cm, adult females 26 cm.

Interest to Fisheries: None at present.

Literature: Bigelow & Schroder (1948); Springer (1966, 1979); Springer & Sadowsky (1970).

9.2 FAMILY PROSCYLLIIDAE Fowler, 1941

PROS

Subfamily Proscylliinae Fowler, 1941 (Family Scyliorhinidae).

Synonymy: None.

FAO Names: En - Finback catsharks; Fr - Requins chat; Sp - Tollos coludos.

Field Marks: Sharks with elongate, catlike eyes with nictitating eyelids, nostrils without barbels or nasoral grooves, mouth long and angular, arched and reaching past anterior ends of eyes, labial furrows very short or absent, small cuspidate teeth, two small, spineless dorsal fins and anal fin, the first dorsal base well ahead of pelvic bases, no precaudal pits, and the caudal fin without a strong ventral lobe or lateral undulations on its dorsal margin.

Diagnostic Features: Head without laterally expanded blades; eyes elongated and fusiform, oval, or slitlike, with lengths over 2 times height; nictitating eyelids rudimentary; spiracles present and moderately large; anterior nasal flaps broadly angular, not barbel-like; internarial width about 0.5 to 1.9 times nostril width; labial furrows absent or very short; teeth small, with acute narrow cusps, often lateral cusplets, and strong basal ledges and grooves, not bladelike and similar in both jaws; posterior teeth comblike; tooth rows 46 to 99/49 to 114. Precaudal pits absent. First dorsal fin small and not keel-like, much shorter than caudal fin; first dorsal base well ahead of pelvic bases, but usually closer to pelvic bases than to pectorals; midpoint of first dorsal base always in front of pelvic origins; pectoral fins with radials confined to bases of fins; ventral caudal lobe absent or very weak; no undulations or ripples in dorsal caudal margin. Neurocranium with supraorbital crests; vertebral centra without strong, wedge-shaped intermedial calcificiations. Valvular intestine with a spiral valve of 6 to 11 turns. Some species with variegated colour patterns, others without them. Development oviparous or ovoviviparous.

Habitat, Distribution and Biology: This is a small family of poorly-known, deepwater sharks with a disjunct distribution in tropical to warm temperate waters of the western North Atlantic and Indo-West Pacific. Finback catsharks live on the outer continental and insular shelves and upper slopes, on or near the bottom, at depths of 50 to 713 m. Their size is small; none exceed 1.2 m, and one species, *Eridacnis radcliffei*, is one of the two smallest sharks known. Most of the species are ovoviviparous, except for the oviparous *Proscyllium habereri*. Food of these harmless sharks consists of small fishes and invertebrates.

Interest to Fisheries: Minimal, a few species are taken by commercial bottom trawlers, but their small size makes them unsuitable for fisheries utilization other than for fishmeal.

Remarks: The arrangement of this family follows Compagno (1979).

Key to Genera :

1a. Head and snout bell-shaped in dorsoventral view (Fig. 1a). No oral papillae or gillrakers in mouth (Fig. 2) .... **Gollum**

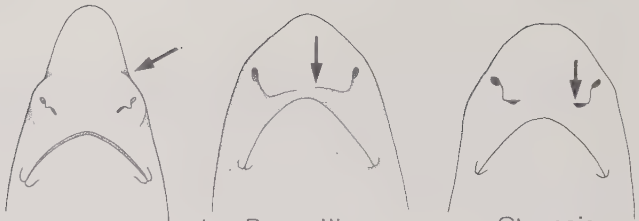
1b. Head and snout narrowly rounded in dorsoventral view (Fig. 1b,c). Oral papillae and gillrakers present in mouth

2a. Caudal fin narrow and ribbonlike. No colour pattern (Fig. 3) .... **Eridacnis**

2b. Caudal fin broad and not ribbonlike. A colour pattern of spots, saddles and bars present (Figs 4,5)

3a. Anterior nasal flaps large, with posterior ends nearly reaching upper symphysis (Fig. 1b). Body very slender. First dorsal origin behind pectorals. Colour pattern of round dark brown spots and indistinct saddles (Fig. 4) .... **Proscyllium**

3b. Anterior nasal flaps smaller, with posterior ends falling well in front of mouth (Fig. 1c). Body rather stout. First dorsal origin in front of pectoral rear tips. Colour pattern a unique combination of large red undulating blotches, spots, and lines (Fig. 5) .... **Ctenacis**


a. Gollum b. Proscyllium c. Ctenacis

underside of head

Fig. 1

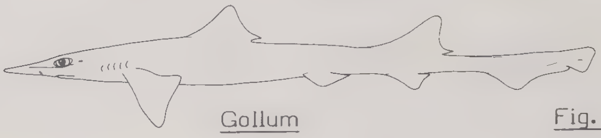

Gollum

Fig. 2

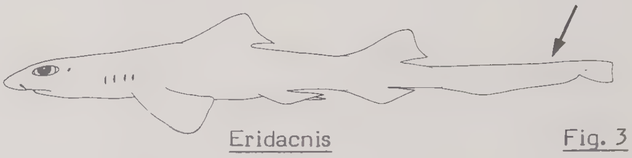

Eridacnis

Fig. 3

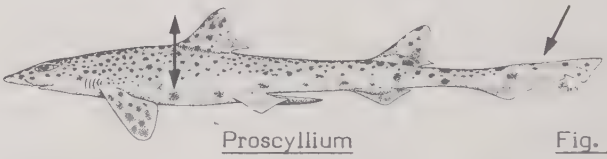

Proscyllium

Fig. 4

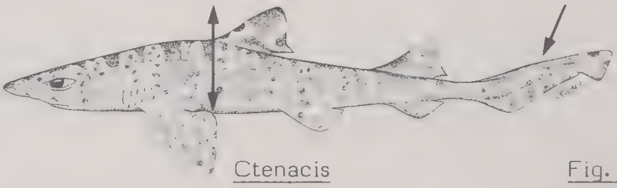

Ctenacis

Fig. 5

Ctenacis Compagno, 1973

PROS Cten

Genus : Ctenacis Compagno, 1973, Proc.Calif.Acad.Sci., Ser. 4, 39(14):258.

Type Species : Triakis fehlmanni Springer, 1968, by original designation.

Synonymy : None.

Diagnostic Features : Body rather stocky. Head and snout not bell-shaped in dorsoventral view; preoral snout length about 2/3 of mouth width; anterior nasal flaps small, with rear edges well in front of mouth; internarial space 1.2 times in nostril width; inside of mouth and edges of gill bars with papillae. First dorsal origin slightly anterior to free rear tips of pectorals, base closer to pelvic bases than pectoral bases; anal origin slightly posterior to second dorsal origin; caudal fin broad, not tapelike, and short, dorsal margin about 23% of total length. A unique colour pattern of large, reddish-brown, irregular dorsal saddle blotches on body, interspersed with smaller round spots and vertical bars, as well as spots on fins.

Remarks : Treatment of this genus follows Compagno (1973, 1979).

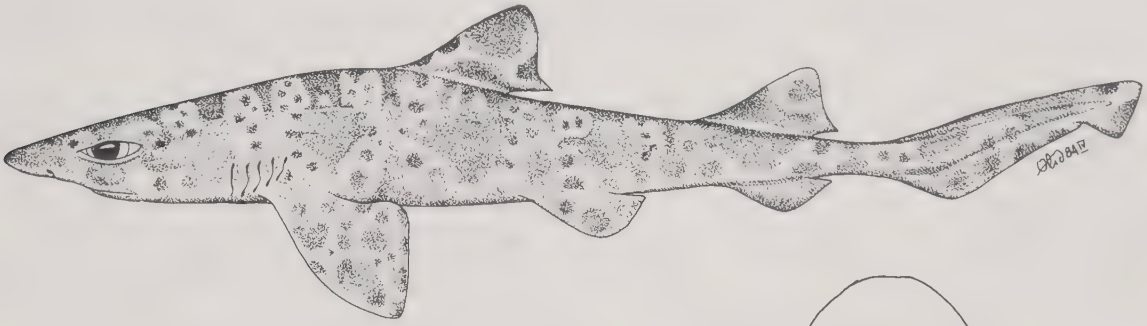
Ctenacis fehlmanni (Springer, 1968)

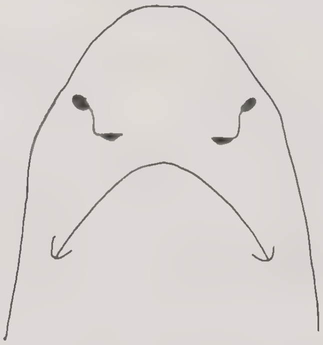
PROS Cten 1

Triakis fehlmanni Springer, 1968, *Proc.Biol.Soc.Wash.*, 81:614, fig. 1-4, 5C. Holotype: U.S. National Museum of Natural History, USNM-202969, 460 mm adult female. Type Locality: Southwest of Cape Guardafui, Somalia, 11°24'N, 51°35'E, from 70 to 170 m depth.

Synonymy : None.

FAO Names : En - Harlequin catshark; Fr - Requin chat arlequin; Sp - Tollo coludo arlequín.

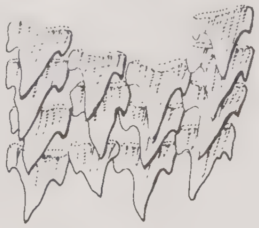




underside of head

Field Marks : The reddish-brown blotched, spotted and barred colour pattern of this shark is unique; also, an anal fin and two equal-sized, spineless dorsal fins, the first over abdomen slightly closer to pelvic fins than pectorals, nictitating eyelids, a triangular mouth, very short labial furrows, comblike posterior teeth, short anterior nasal flaps that do not reach mouth, and a stout body and tail.

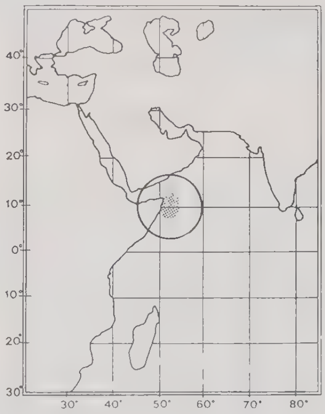
Diagnostic Features : See genus.



upper teeth

Geographical Distribution : As presently known, confined to the northwestern Indian Ocean, off Somalia.

Habitat and Biology : A poorly known tropical bottom-dwelling shark from the outer continental shelf off Somalia, known only from the holotype. Mode of development uncertain, though the presence of a very thin-walled (rather than thick-walled) large egg-case in each uterus of the holotype suggests that the species may be ovoviviparous rather than oviparous like *Proscyllium habereri*; if ovoviviparous, presumably the holotype would have had two young in a litter. An unidentified crustacean was found in the stomach of the holotype, and the describer of this shark (S. Springer) speculated that its large mouth, small teeth, and large pharynx with gillraker papillae might allow it to feed on very small invertebrates.



Size : Maximum 46 cm (adult female).

Interest to Fisheries : None at present.

Literature : Springer (1968); Compagno (1973, 1979); Bass, D'Aubrey & Kistanasamy (1975).

Eridacnis Smith, 1913

PROS Erid

Genus : Eridacnis Smith, 1913, Proc.U.S.Natl.Mus., 45(2003):599.

Type Species : Eridacnis radcliffei Smith, 1913, by original designation.

Synonymy : Genus Neotriakis Smith, 1957.

Diagnostic Features : Body rather slender. Head and snout not bell-shaped in dorsoventral view; preoral snout length subequal to about 2/3 of mouth width; anterior nasal flaps small, with rear edges well in front of mouth; internarial space 0.7 to 1.3 times in nostril width; inside of mouth and edges of gill bars with papillae. First dorsal origin varying from well anterior to slightly posterior to free rear tips of pectorals, base closer to pelvic bases than pectoral bases; anal origin slightly anterior, under or slightly posterior to seond dorsal origin; caudal fin very narrow, tapelike, and long, dorsal margin 25 to 30% of total length. No colour pattern, except vertical barring on caudal fin.

Remarks : Treatment of this genus follows Compagno (1970, 1979). Members of this genus had been previously placed in four genera, Eridacnis (for E. radcliffei), Neotriakis (for E. sinuans), Proscyllium (for P. alcocki, a synonym of E. radcliffei), and Triakis (for T. barbouri) by various writers.

Key to Species :

1a. Preoral snout over twice mouth length. Lateral dermal denticles broad and with short, wide cusps .... **E. sinuans**

1b. Preoral snout less than 1.5 times mouth length. Lateral dermal denticles narrow and with narrow, long cusps

  2a. Labial furrows rudimentary or absent. Anal fin less than half height of dorsal fins. Colour dark brown with blackish markings on dorsal fins .... **E. radcliffei**

  2b. Labial furrows short but well-developed. Anal fin about two-thirds of dorsal fin heights. Colour greyish brown with light edges on dorsal fins .... **E. barbouri**

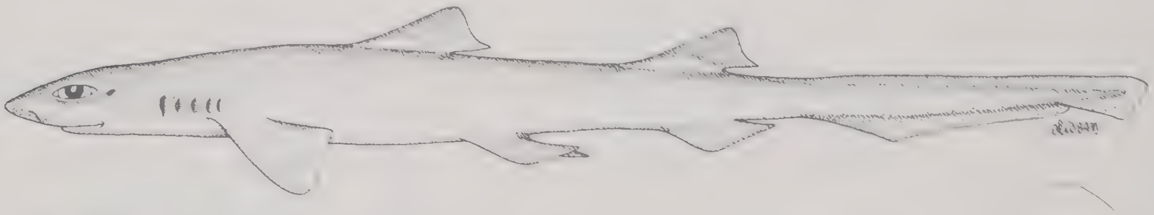
Eridacnis barbouri (Bigelow & Schroeder, 1944)

PROS Erid 1

Triakis barbouri Bigelow & Schroeder, 1944, Proc.New England Zool.Club, 23:27, pl. 8. Holotype: Museum of Comparative Zoology, Harvard, MCZ-36099, 283 mm adult male. Type Locality: Off Santa Clara Province, north coast of Cuba.

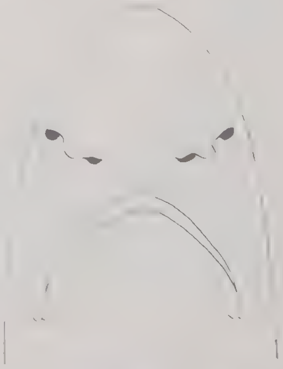
Synonymy : None.

FAO Names : En - Cuban ribbontail catshark; Fr - Requin chat cubain; Sp - Tollo coludo cubano.



Field Marks : A dwarf, slender sharklet with an anal fin and two equal-sized, spineless dorsal fins, first dorsal fin over abdomen and slightly closer to pelvic fins than pectorals, preoral snout less than 1.5 times the mouth length, nictitating eyelids, a triangular mouth, very short labial furrows, comblike posterior teeth, short anterior nasal flaps that do not reach mouth, no nasoral grooves or barbels, a long, narrow, ribbonlike caudal fin with faint dark banding, and light grey coloration.

Diagnostic Features : Preoral snout less than 1.5 times mouth length; labial furrows very short. Dorsal fins small and low, with anterior margin of first dorsal at a low angle to body axis; anal fin height over half dorsal heights; junction of preventral and postventral caudal margins angular. Lateral trunk denticles narrow-crowned and with long, narrow cusps. Colour light grey.



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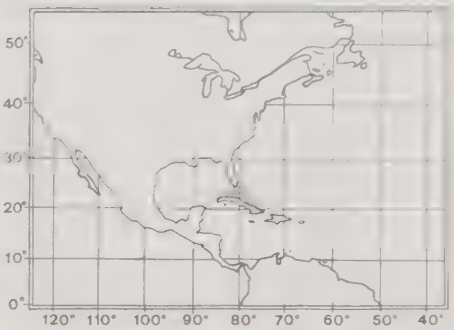
Geographical Distribution : Apparently confined to a limited area in the western North Atlantic in the Florida Straits and off the north coast of Cuba.



Habitat and Biology : A common, small subtropical bottom shark of the upper continental and insular slopes at depths of 430 to 613 m. Ovoviviparous, number of young two in a litter. Food habits not reported, but probably feeds on small fishes, crustaceans and cephalopods.

Size : Maximum about 34 cm; males mature at about 27 cm and females 28 cm; size at birth over 10 cm.

Interest to Fisheries : None at present.

Literature : Bigelow & Schroeder (1948); Compagno (1978, 1979).

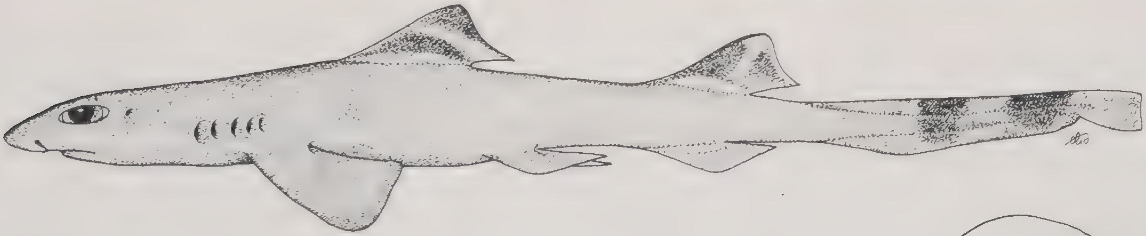
Eridacnis radcliffei Smith, 1913

PROS Erid 2

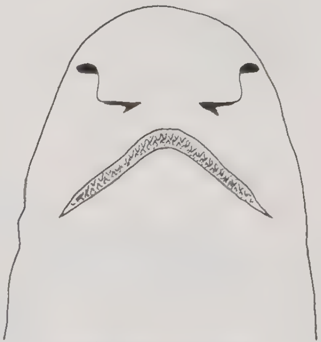
Eridacnis radcliffei Smith, 1913, Proc.U.S.Natl.Mus., 45(2003):599, figs 1-3, pl. 47. Holotype: U.S. National Museum of Natural History, USNM-74604, 230 mm adult female. Type Locality: Off Jolo Light, Jolo Island, Sulu Archipelago, The Philippines, 6°11.8'N, 121°08.3'E, 295 m depth.

Synonymy : Proscyllium alcocki Misra, 1950.

FAO Names : En - Pygmy ribbontail catshark; Fr - Requin chat pygmé; Sp - Tollo coludo pigmeo.



Field Marks : One of the smallest living sharks, not exceeding 24 cm, with anal fin and two equal-sized, spineless dorsal fins, first dorsal fin over abdomen and slightly closer to pelvic fins than pectorals, preoral snout less than 1.5 times mouth length, nictitating eyelids, a triangular mouth, labial furrows rudimentary or absent, comblike posterior teeth, short anterior nasal flaps that do not reach mouth, no nasoral grooves or barbels, a long, narrow, ribbonlike caudal fin with prominent dark banding, and brown coloration.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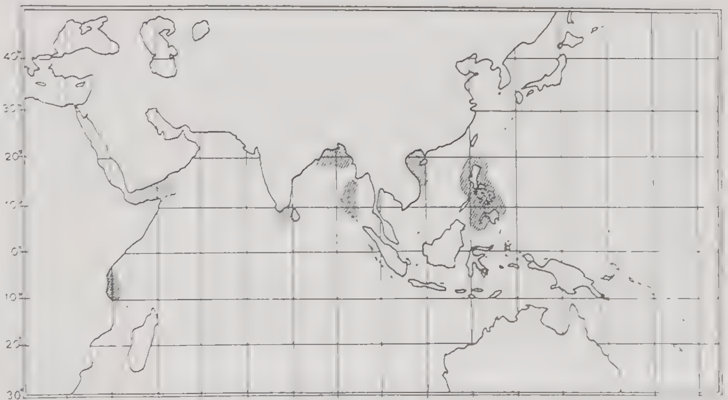
Diagnostic Features : Preoral snout less than 1.5 times mouth length; labial furrows rudimentary or absent. Dorsal fins fairly large and high, with anterior margin of first dorsal at a low angle to body axis; anal fin height less than half dorsal heights; junction of preventral and postventral caudal margins broadly rounded. Lateral trunk denticles narrow-crowned and with long, narrow cusps. Colour brown, with prominent dark banding on tail and dark markings on dorsal fins.

Geographical Distribution : Wide-ranging in the Indo-West Pacific, but with spotty records from Tanzania, the Gulf of Aden, India (Gulf of Mannar, Bay of Bengal), the Andaman Islands, Viet Nam, and the Philippines. The immense range of this species is striking compared to the limited ranges of other members of the genus Eridacnis.



Habitat and Biology : A deepwater tropical benthic shark that often occurs on mud bottoms, on the upper continental and insular slopes and the outer shelves at depths from 71 to 766 m. In some areas where it occurs (particularly southern India and the Philippines), the pygmy ribbontail shark is very common.

Ovoviviparous, number of young 1 or 2 in a litter. Fetuses resorb their yolk sacs and are ready for birth at about 10.1 to 10.7 cm length. This shark is extraordinary in the great size of full-term young compared to their mothers, and the small size of females at maturity. Examination of females in Indian waters show that these may become pregnant at 16.6 cm length or less (large eggs appear at about 15 cm). It is possible that females grow considerably while pregnant, as only the larger females above 18 cm have large, near or full-term young, while small females below 17 cm only have embryos in earlier stages.

Feeds primarily on small bony fishes and crustaceans, with squid a lesser component of its diet. In the stomachs of over 300 specimens from Indian waters bony fishes, particularly lanternfishes but also bristlemouths (Gonostomatidae), small eels and digested fish remains formed about 55% of this shark's diet by volume; crustaceans, primarily deepwater shrimp but also stomatopods and crab larvae occurred at 28% by volume; squid occurred at about 14% by volume, but few other items were recorded (bivalves in one stomach).

Size : Maximum 24 cm; males mature at 18 to 19 cm or less, and reach 23 cm; females mature at about 15 to 16 cm and reach 24 cm; size at birth about 11 cm. This is one of the two smallest living sharks known at present, and is only rivalled in size by the squaloid Squaliolus laticaudus.

Interest to Fisheries : Minimal, taken in commercial bottom trawls in the Philippines, but utilization there is not known.

Literature : Smith (1913); Norman (1939); Fowler (1941); Misra (1950); Bessednov (1969); Compagno (1970, 1979); Nair & Appukuttan (1973, 1974); Nair & Lal Mohan (1973); G. Bianchi (pers.comm.).

Remarks : The writer examined the holotype of Proscyllium alcocki Misra, 1947 (ZSI F 229/1, a 208 mm adult male) in the collections of the Zoological Survey of India, Calcutta, and was able to confirm the synonymy of Misra's species with Eridacnis radcliffei.

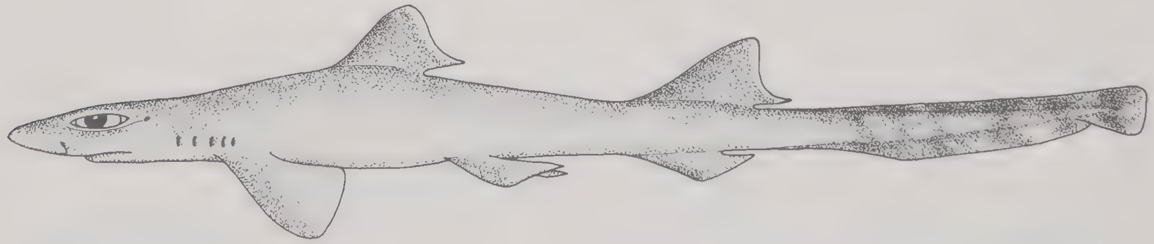
Eridacnis sinuans (Smith, 1957)

PROS Erid 3

Neotriakis sinuans Smith, 1957, S.Afr.J.Sci., 53(10):262, fig. 2. Holotype: J.L.B. Smith Institute of Ichthyology, Grahamstown, South Africa, RUSI 31, 331 mm adult male. Type Locality: Off Durban, South Africa, at 329 m depth.

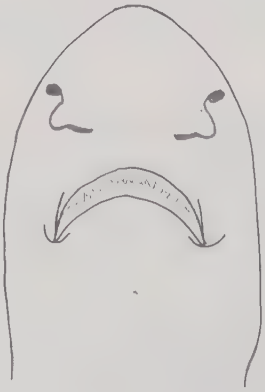
Synonymy : None.

FAO Names : En - African ribbontail catshark; Fr - Requin chat à rubans; Sp - Tollo coludo africano.



Field Marks : A dwarf, slender sharklet with an anal fin and two equal-sized, spineless dorsal fins, first dorsal fin over abdomen slightly closer to pelvic fins than pectorals, preoral snout over two times mouth length, nictitating eyelids, a triangular mouth, very short labial furrows, comblike posterior teeth, short anterior nasal flaps that do not reach mouth, no nasoral grooves or barbels, a long, narrow, ribbonlike caudal fin with faint dark banding, and grey-brown coloration.

Diagnostic Features : Preoral snout over two times mouth length; labial furrows very short. Dorsal fins moderately large and



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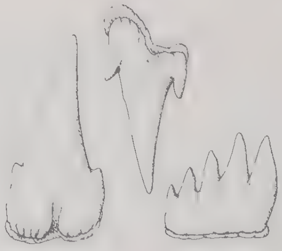
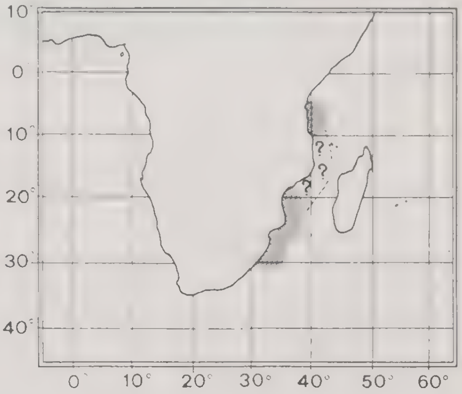


teeth

high, with anterior margin of first dorsal at a high angle to body axis; anal fin height less than half dorsal heights; junction of preventral and postventral caudal margins broadly rounded. Lateral trunk denticles broad-crowned and with short, broad cusps. Colour brownish grey, with dark banding on caudal fin and light margins on dorsal fins.

Geographical Distribution : Confined to the southwestern Indian Ocean off South Africa, Mozambique and Tanzania.



Habitat and Biology : A deepwater warm-temperate and tropical bottom-dwelling shark of the upper continental slope and outer shelf of east and southern Africa at depths of 180 to 480 m. Apparently geographic or bathymetric segregation of populations by sex occurs, as most specimens taken off Natal are male.

Oviparous, number of young in a litter two. A harmless small shark that feeds on small bony fishes, crustaceans, and cephalopods.

Size : Maximum 37 cm, males maturing at about 29 or 30 cm and reaching at least 30 cm, females mature at 37 cm; size at birth between 15 and 17 cm.

Interest to Fisheries : Minimal or nil.

Literature : Smith (1957); Bass, D'Aubrey & Kistnasamy (1975); G. Bianchi (pers.comm.).

Gollum Compagno, 1973

PROS Gol

Genus : Gollum Compagno, 1973, Proc.Calif.Acad.Sci., 39(14):264.

Type Species : Triakis attenuata Garrick, 1954, by original designation.

Synonymy : None.

Diagnostic Features : Body slender. Head and snout bell-shaped in dorsoventral view; preoral snout length about equal to mouth width; anterior nasal flaps small, ending well in front of mouth; internarial space 1.8 to 1.9 times the nostril width; inside of mouth and edges of gill bars without papillae. First dorsal origin slightly anterior to or over free rear tips of pectorals, base closer to pectoral bases than pelvic bases; anal origin posterior to second dorsal origin; caudal fin broad, not tapelike, and short, dorsal margin about 19 to 21% of total length. No colour pattern, brownish-grey above, light below.

Remarks : Treatment of this genus follows Compagno (1973, 1979).

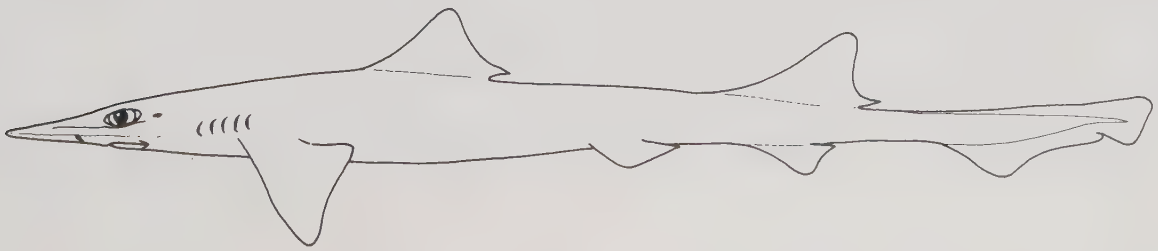
Gollum attenuatus (Garrick, 1954)

PROS Gol 1

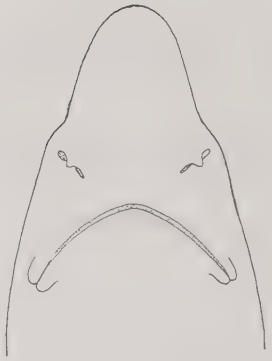
Triakis attenuata Garrick, 1954, Trans.R.Soc.N.Z., 82(3):698, figs 1-2. Holotype: National Museum of New Zealand (formerly Dominion Museum), DM (or NMNZ) 1509, 932 mm adult male. Type Locality: Cape Palliser, east coast of North Island, New Zealand, 220 m depth.

Synonymy : None.

FAO Names : En - Slender smooth-hound; Fr - Requin chat golloum; Sp - Tollo coludo elegante.



Field Marks: A moderately small shark with a very long and narrow snout, bell-shaped in dorsoventral view and laterally wedge-shaped, an anal fin and two equal-sized, spineless dorsal fins, the first over abdomen slightly closer to pectoral fins than to pelvics, nictitating eyelids, a large, triangular mouth with short labial furrows and small, numerous cuspidate teeth, the posteriors rather comblike, short anterior nasal flaps that do not reach mouth, a slender body and tail, and no colour pattern.



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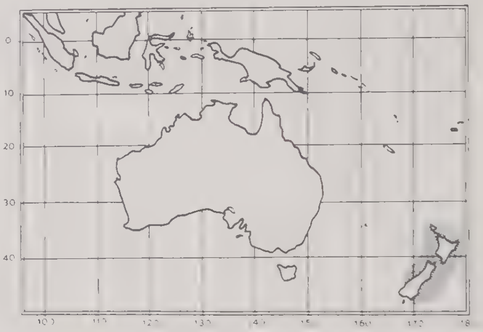
Diagnostic Features: See genus.

Geographical Distribution: Apparently confined to the western South Pacific, off New Zealand.



Habitat and Biology: A little-known, uncommon bottom-dwelling shark of the outermost continental shelf and upper slope of New Zealand temperate waters, found at depths of 200 to 439 m. Ovoviviparous, size of litters not recorded. Food habits not known, presumably eats small fishes and invertebrates.

Size: Maximum size about 1 m; an adult female is 101 cm; mature males from 93 to 96 cm.

Interest to Fisheries: None at present as far as is known, although this shark is taken in small numbers by bottom trawlers fishing in deep water.

Literature: Garrick (1954); Springer (1968); Compagno (1973, 1979); Garrick & Paul (1975a); J.A.F. Garrick (pers.comm.).

Proscyllium Hilgendorf, 1904

PROS Pros

Genus: Subgenus *Proscyllium* Hilgendorf, 1904 (Genus *Scyllium* Cuvier, 1817), *Sonderaldr.Sitz.-Ber.Ges. Naturforsch.Freunde Jahrg.*, 1904(2):39.

Type Species: *Proscyllium habereri* Hilgendorf, 1904, by original designation under the usage formula "*Proscyllium habereri* nov. subgen., n.spec.".

Synonymy: Genus *Calliscyllium* Tanaka, 1912.

Diagnostic Features: Body rather slender. Head and snout not bell-shaped in dorsoventral view; preoral snout length about 2/3 of mouth width; anterior nasal flaps large, with rear edges nearly reaching mouth; internarial space 0.4 to 0.6 times nostril width; inside of mouth and edges of gill bars with papillae. First dorsal origin well posterior to pectorals, its base closer to pelvic bases than pectoral bases; anal origin somewhat anterior to second dorsal origin; caudal fin broad, not tapelike, and short, dorsal margin about 17 to 21% of total length. A colour pattern of small to large dark brown spots and sometimes small white spots and indistinct dusky saddle blotches on body and fins.

Remarks: As noted in Compagno (1970, 1979), the taxonomic history of the genus *Proscyllium* and its synonym *Calliscyllium* has been extremely confused. *Proscyllium* was proposed by Hilgendorf (1904) as a subgenus for the new species *P. venustum* from Taiwan, while Tanaka (1912) described a congeneric and likely conspecific shark from Japan as *Calliscyllium venustum* without reference to Hilgendorf's earlier account. Various authors have recognized either or both of these genera or synonymized one or both of them with *Triakis*, and sometimes placed them in different families (*Calliscyllium* in the Triakidae and *Proscyllium* in the Scyliorhinidae), but Compagno (1970) synonymized these genera and recognized *Proscyllium* as a valid genus.

Proscyllium habereri Hilgendorf, 1904

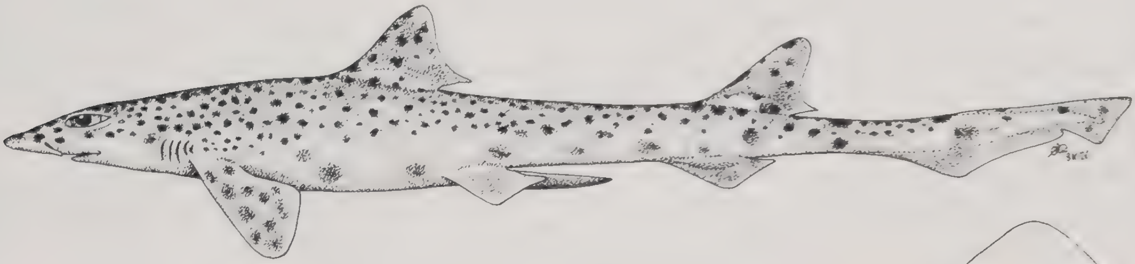
PROS Pros 1

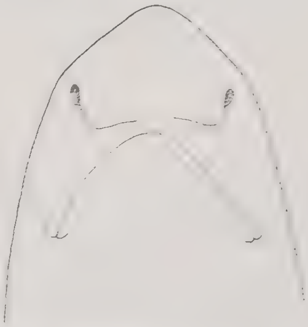
Proscyllium habereri Hilgendorf, 1904, Sonderaldr.Sitz.-Ber.Ges.Naturforsch.Freunde Jahrg., 1904(2):39. Holotype: Zoologisches Museum für Naturkunde der Humboldt Universität, Berlin, ZMB 16201, 513 mm adult male. Type Locality: Takao, Formosa.

Synonymy : Calliscyllium venustum Tanaka, 1913.

Other Scientific Names Recently in Use : Triakis venusta (Tanaka, 1913).

FAO Names : En - Graceful catshark; Fr - Requin chat gracile; Sp - Tollo coludo grácil.





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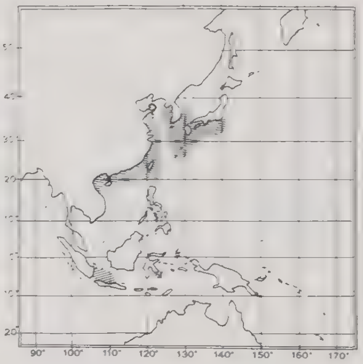
Field Marks : A small shark with a spotted colour pattern, an anal fin and two equal-sized, spineless dorsal fins, the first over abdomen slightly closer to pelvic fins than pectorals, large eyes with nictitating eyelids, a triangular mouth that reaches past eyes, very short labial furrows, very small cuspidate teeth including comblike posteriors, large anterior nasal flaps that nearly reach mouth, no barbels or nasoral grooves, and a slender body and rather long tail.

Diagnostic Features : See genus.



Geographical Distribution : Western Pacific: Northwestern Java, Viet Nam, China (including Taiwan Island), Korea, Riu-Kiu Islands, southeastern Japan.

Habitat and Biology : A little-known, uncommon bottom-dwelling shark of tropical and warm-temperate continental and insular waters, found on the shelves at depths from 50 to 100 m. Oviparous, probably depositing an egg per uterus. Food habits little-known; 6 specimens from the Taiwan Straits examined by the writer had digested remains of bony fishes, a crab, and an unidentified cephalopod (possibly an octopus) in their stomachs.

Size : Maximum 65 cm; adult males from 42 to 57 cm, adult females from 51 to 65 cm.

Interest to Fisheries : Probably small, taken by bottom trawlers in the Taiwan Straits and elsewhere in its range, utilization unknown.

Literature : Tanaka (1912, 1915); Schmidt (1928, 1930); White (1936, 1937); Fowler (1941); Bigelow & Schroeder (1948); Compagno (1970, 1979); Nakaya (1983).

Remarks : Calliscyllium venustum Tanaka, 1915, is tentatively included in synonymy of Proscyllium habereri, though there apparently were slight differences in coloration between the holotypes of the two species. Unfortunately the holotype of C. venustum is apparently lost (Nakaya, 1983), so direct comparison of these specimens is no longer possible. However, examination of a number of Proscyllium specimens from Okinawa, Taiwan Island, the South China Sea, and Java showed that these vary considerably in coloration, suggesting that one variable species may be involved (Compagno, 1979). Nakaya (1983) has given a detailed redescription of the holotype of Proscyllium habereri.

9.3 FAMILY PSEUDOTRIAKIDAE Gill, 1893 (emended)

PSEUDOT

Subfamily Pseudotriacinae, Gill, 1893, (Family Scylliorhinidae; emended to Family Pseudotriakidae by Jordan & Evermann, 1896).

Synonymy : None.

FAO Names : En - False catsharks; Fr - Requins à longue dorsale; Sp - Musolones.

Diagnostic Features : Head without laterally expanded blades; eyes elongated and slitlike, their lengths over 2 times the height; nictitating eyelids rudimentary; spiracles present and very large; anterior nasal flaps broadly angular, not barbel-like; internarial width about 2.8 times the nostril width; labial furrows very short; teeth small, with acute narrow cusps, lateral cusplets, and strong basal ledges and grooves, not bladelike and similar in both jaws; posterior teeth comblike; tooth rows very numerous, 202 to 294/258 to 335. Precaudal pits absent. First dorsal fin very large, low and formed as a rounded keel, about as long as caudal fin; first dorsal base on back with insertion just opposite pelvic origins and origin about opposite free rear tips of pectorals; midpoint of first dorsal base well in front of pelvic origins; pectoral fins with radials confined to bases of fins; ventral caudal lobe absent or very weak; no undulations or ripples in dorsal caudal margin. Neurocranium with supraorbital crests; vertebral centra without strong, wedge-shaped intermedial calcifications. Valvular intestine with a spiral valve of 17 turns. Colour plain except for darker fins. Development ovoviviparous.

Remarks : Most writers recognize this family for the false catsharks, Pseudotriakis. See Compagno (1979) for a discussion of the rationalle for recognizing the family and its relationships to other carcharhinoids. The odd New Zealand proscylliid Gollum is thought to be the closest living relative of Pseudotriakis, and there is some merit in an alternate scheme of including Gollum and Pseudotriakis in a common taxon (Compagno, 1979).

Pseudotriakis Capello, 1868

PSEUDOT Pseu

Genus : Pseudotriakis Capello, 1868, J.Sci.Math.Phys.Nat.Lisboa, ser. 2, (4):321.

Type Species : Pseudotriakis microdon Capello, 1868, by monotypy.

Synonymy : Genus Pseudotriacis Günther, 1870 (emended spelling).

Remarks : Two species of Pseudotriakis are commonly recognized, the Atlantic P. microdon Capello, 1867 and the Pacific P. acrales Jordan & Snyder, 1904. Elsewhere, the writer has traced the taxonomic history of Pseudotriakis (Compagno, 1979), and noted that several writers have disagreed on the validity of P. acrales. The writer has compared the holotype of P. acrages (Stanford University, SU 12903, 1765 mm immature male, from Suruga Gulf, Japan) with various literature accounts of the two species as well as with specimens of Pseudotriakis from the North Sea and from the Hawaiian Islands. This resulted in the writer being unable to find any reliable characters to separate Atlantic and Pacific Pseudotriakis, although it was initially thought that the Atlantic species might have a longer snout. The criteria that Jordan & Snyder (1904) and Bigelow & Schroeder (1948) proposed to separate these species do not hold, and hence, they are tentatively synonymized here.

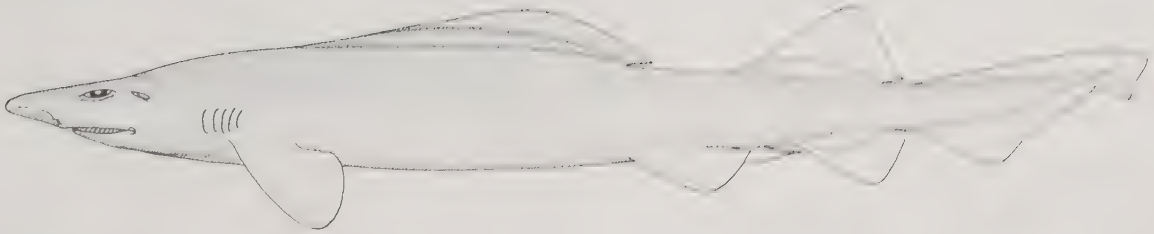
Pseudotriakis microdon Capello, 1868

PSEUDOT Pseu 1

Pseudotriakis microdon Capello, 1868, J.Sci.Math.Phys.Nat.Lisboa, ser. 2, (4):321, pl. 5. Holotype: Museu Bocage, Lisbon, Portugal, 2310 mm adult male, lost in fire that recently destroyed this museum. Type Locality: Setubal, Portugal.

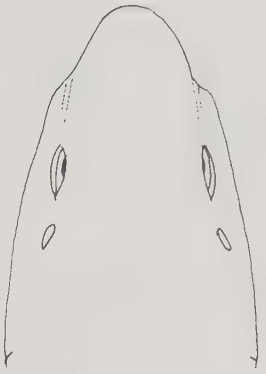
Synonymy : Pseudotriakis acrales Jordan & Snyder, 1904; Pseudotriakis acrages Garman, 1913 (emended spelling for acrales).

FAO Names : En - False catshark; Fr - Requin à longue dorsale; Sp - Musolón de aleta larga.

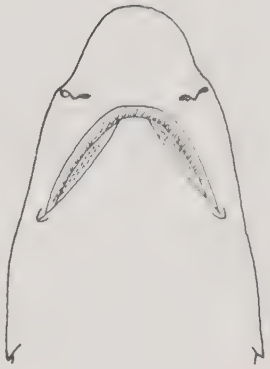


Field Marks : A large, bulky, dark-brown, soft-bodied shark with elongated, catlike eyes and nictitating eyelids, large spiracles, a huge, wide, angular mouth that reaches behind eyes, very short labial furrows, numerous small cuspidate teeth in 200 or more rows in each jaw, two large spineless dorsal fins and an anal fin, a low, long, keel-like first dorsal fin on back, no precaudal pits, and a caudal fin without a strong ventral lobe or lateral undulations on its dorsal margin.

Diagnostic Features : See family.



dorsal view of head



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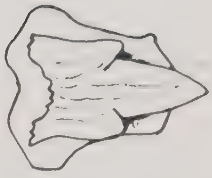
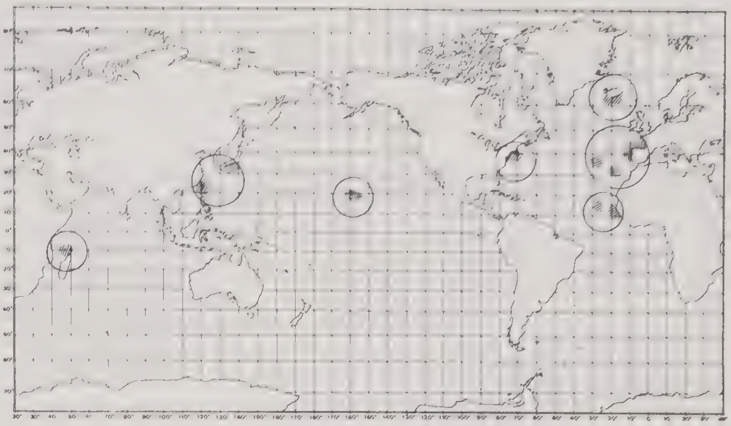


dermal denticle

Geographical Distribution : Western North Atlantic: New York to New Jersey. Eastern North Atlantic: Atlantic Slope off Iceland, France, Portugal, Madeira, Azores, Senegal, and Cape Verde Islands. Western Indian Ocean: Aldabra Islands group. Western Pacific: Japan and Taiwan Island. Central Pacific: Hawaiian Islands.

Habitat and Biology : A big deepwater bottom-dwelling shark of the continental and insular slopes at depths from 200 to 1500 m; occasionally wandering onto continental shelves, even in shallow water (possibly abnormally). The large body cavity, soft fins, and soft skin and musculature of this shark suggests that it is relatively inactive and sluggish, and can hover off the bottom at virtually neutral buoyancy.



Ovoviviparous, with litters of 2 to possibly 4 young. At 8 to 32 cm length embryos have large yolk sacs with abundant yolk, but the considerably larger size attained by term fetuses, the small litter size of this shark, and the immense number of eggs produced by adult females (estimated at 20 000 in one ovary for a 280 cm adult female) led Forster et al. (1970) to suggest that this shark may have oophagy or uterine cannibalism as in lamnoid sharks. This hypothesis remains unproven, however.

Feeding habits little-known, once photographed in deep water in the Indian Ocean eating a bony fish used as bait on the camera. Probably feeds on a variety of deepwater bony fishes, elasmobranchs and invertebrates. Its teeth are small but sharp-cusped, and its mouth is very large, which may allow prey organisms of considerable size to be ingested.

Size : Maximum 295 cm; adult males from 200 to 269 cm, adult females reported from 212 to 295 cm; size at birth between 70 and 85 cm.

Interest to Fisheries : Minimal, taken on deep-set longlines and less commonly in bottom trawls. Utilization not reported.

Literature : Lozano y Rey (1928); Bigelow & Schroeder (1948); Forster et al. (1970); Compagno (1979, 1981); Cadenat & Blache (1981).

9.4 FAMILY LEPTOCHARIIDAE Gray, 1851

LEPTOC

Tribe Leptochariana Gray, 1851 (Family Squalidae), London, British Museum (Natural History), Pt. 1, Chondropterygii:39.

Synonymy : None.

FAO Names : En - Barbeled houndsharks; Fr - Emissoles; Sp - Tiburones barbudos.

Diagnostic Features : Head without laterally expanded blades; eyes horizontally oval, with lengths less than 2 times height; nictitating eyelids internal; spiracles present and very small; anterior nasal flaps formed into slender barbels; internarial width about 2.5 to 3.2 times the nostril width; labial furrows very long; teeth small, with acute narrow cusps, lateral cusplets, and strong basal ledges and grooves, not bladelike and similar in both jaws; posterior teeth not comblike; tooth rows 49 to 60/43 to 54. Precaudal pits absent. First dorsal fin small and not keel-like, much shorter than caudal fin; first dorsal base well ahead of pelvic bases, slightly closer to pectoral bases than pelvics; pectoral fins with radials confined to bases of fins; ventral caudal lobe absent or very weak; no undulations or ripples in dorsal caudal margin. Neurocranium without supraorbital crests; vertebral centra with strong, wedge-shaped intermedial calcificiations. Valvular intestine with a spiral valve of 14 to 16 turns. Colour grey above, light below, no colour pattern. Development viviparous, with a unique globular placenta.

Remarks : The single genus and species, Leptocharias smithii, is conventionally placed in the family Triakidae or Carcharhinidae, but a study of its morphology (Compagno, 1979) shows that it is rather divergent in morphology from triakids. It is thereby placed in its own family, Leptochariidae. See Compagno (1979) for a detailed discussion of the morphology and relationships of Leptocharias.

Leptocharias Smith, 1838

LEPTOC Lep

Genus : Leptocharias Smith, in Müller & Henle, 1838, Mag.Nat.Hist.Charlesworth, 2:36.

Type Species : Triaenodon smithii Müller & Henle, 1839, by subsequent designation of Müller & Henle, 1839, Syst.Beschr.Plagiost., pt. 2, 56.

Synonymy : Genus Leptocarias Smith, in Müller & Henle, 1839 (error?); Genus Leptocarcharias Günther, 1870 (emended spelling).

Diagnostic Features : See family.

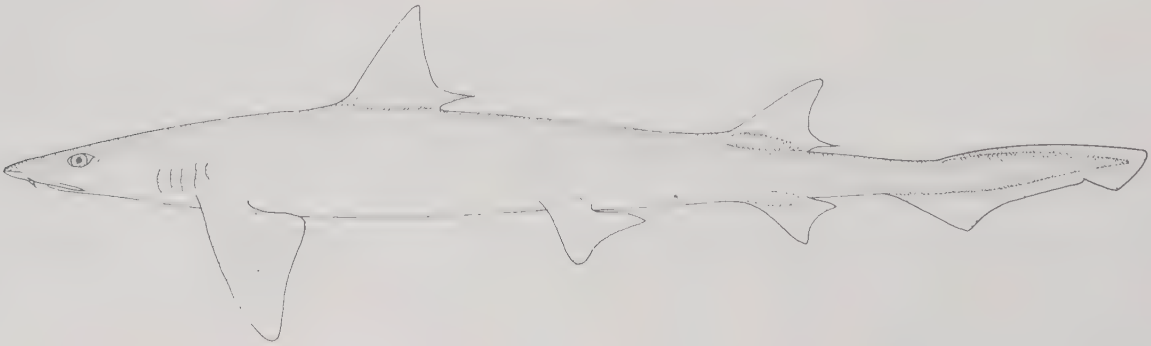
Leptocharias smithii (Müller & Henle, 1839)

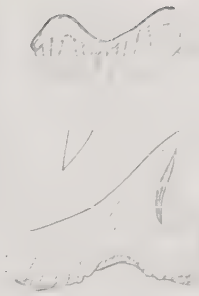
LEPTOC Lep 1

Triaenodon smithii Müller & Henle, 1839, Syst.Beschr.Plagiost., (pt. 2):56, pl. 21. Holotype: British Museum (Natural History), stuffed adult male. Type Locality: "Kabendabay" (Cabinda Bay, Cabinda, Angola).

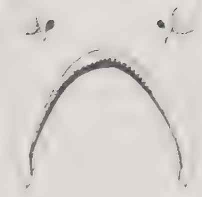
Synonymy : Mustelus osborni Fowler, 1923.

FAO Names : En - Barbeled houndshark; Fr - Emissole barbue; Sp - Tiburón barbudo.





upper and lower tooth



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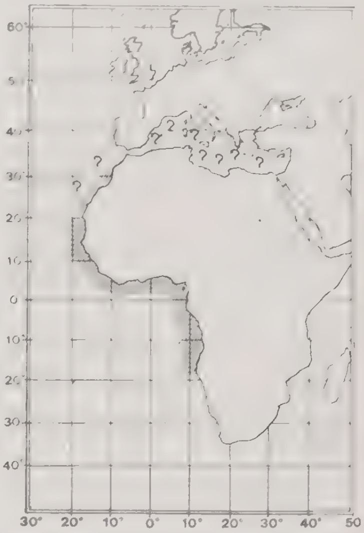
Field Marks : A small, very slender, light grey or grey-brown shark with horizontally oval eyes and internal nictitating eyelids, nostrils with slender barbels but no nasoral grooves, mouth long, arched and reaching past anterior ends of eyes, labial furrows very long, small cuspidate teeth, two small, spineless, equal-sized dorsal fins and an anal fin, the first dorsal fin on the back between pectoral and pelvic fins, no precaudal pits, and the caudal fin without a strong ventral lobe or lateral undulations on its dorsal margin.

Diagnostic Features : See family.

Geographical Distribution : Eastern Atlantic: Mauritania to Angola, possibly north to Morocco and Mediterranean.



Habitat and Biology : This is a small, common, inshore tropical shark of the West African continental shelf, found near the bottom at depths of 10 to 75 m. It is especially abundant off river mouths, prefers muddy bottoms. Water temperatures where it occurs range from 20 to 27°C; salinities from 35 to 36°/oo; oxygen from 3 to 4 ppm. Nothing is known of the behaviour of this little shark, which apparently has never been kept in captivity. Its firm skin and muscles, long strong tail, rather short body caviity and small liver all suggest that it is an active swimmer rather like smooth-hounds (Mustelus, Family Triakidae).

Viviparous, with a unique spherical or globular placenta; two females had litters of 7 young. Pregnant females are found with young from July to October off Senegal, with largest fetuses (up to 20 cm) occurring in October. Presumably the gestation period is at least 4 months.

An unusual morphological feature of the barbeled houndshark is pronounced sexual heterodonty or dental sexual dimorphism. Males have greatly enlarged anterior teeth, possibly of use in courtship and copulation.

This species is a generalized feeder on small bottom and littoral organisms with a preference for crustaceans, and eats a variety of small bony fish including sardines, anchovies, snake eels, blennies, gobies, and flatfish, as well as skate and flyingfish eggs, crabs, shrimp, lobsters, octopi and sponges. It occasionally swallows inedible objects such as feathers and vegetable debris (including flowers).

Size : Maximum 82 cm; males probably maturing at about 55 to 60 cm and definitely adult at 56 to 77 cm; females maturing at or above 52 cm and definitely adult at 58 to 82 cm; size at birth probably above 20 cm.

Interest to Fisheries : Probably important to inshore artisanal fisheries in the West African area, where it is taken with hook and line as well as fixed bottom gillnets; also caught by commercial bottom trawlers. Its flesh is utilized fresh, smoked, or dried salted for human consumption and its skin is used for leather.

Literature : Chabanaud (1932); Poll (1951); Cadenat (1957); Maurin & Bonnet (1970); Compagno (1970, 1979, 1981); Cadenat & Blache (1981).

9.5 FAMILY TRIAKIDAE Gray, 1851

TRIAK

Tribe Triakiana Gray, 1851 (Family Squalidae), London, British Museum (Natural History), Pt. 1, Chondropterygii:39.

Synonymy : Subfamily Musteli Bonaparte, 1838 (Family Squalidae; not Family Mustelini Fischer, 1817 or Family Mustelidae Swainson, 1835 in Mammalia); Family Galei Müller & Henle, 1839; Family Scylliodontes Müller & Henle, 1839; Family Galeorhinoidae Gill, 1862; Family Triakidae White, 1936; Family Scylliogaleidae Whitley, 1940, also Smith, 1957; Family Emissolidae Whitley, 1940; Family Eugaleidae Gurr, 1962; Tribe Iagini Compagno, 1973 (Family Triakidae).

FAO Names : En - Houndsharks, Smooth-hounds, Topes, Whiskery sharks; Fr - Emissoles, Hâs; Sp - Cazones, Tollos.

Field Marks : Small to moderate-sized sharks with horizontally oval eyes, nictitating eyelids, no nasoral grooves, anterior nasal flaps usually not barbel-like except in Furgaleus), a long, angular or arched mouth that reaches past anterior ends of eyes, moderate to very long labial furrows, small to moderately large molariform, bladelike or cuspidate teeth, two moderate to large-sized, spineless dorsal fins and an anal fin, the first dorsal base well ahead of pelvic bases, no precaudal pits, and caudal fin without a strong ventral lobe or lateral undulations on its dorsal margin.

Diagnostic Features: Head without laterally expanded blades; eyes elongated and fusiform, horizontally oval, or slitlike, with lengths over 1.5 to 2.5 times height; nictitating eyelids external, transitional or internal; spiracles present and small to moderately large; anterior nasal flaps varying from elongated to lobular to vestigial, barbel-like in one genus (Furgaleus); internarial width about 0.5 to 3.0 times in nostril width; labial furrows moderately long to very long; teeth small to moderately large, with acute and narrow to moderately large cusps and lateral cusplets in some species, but with these structures reduced or absent in others; teeth with strong basal ledges and grooves; teeth cuspidate and not bladelike, compressed and bladelike, or flattened and molariform; usually similar in both jaws but differentiated in a few species; posterior teeth not comblike; tooth rows 18 to 40/11 to 100. Precaudal pits absent. First dorsal fin moderately large to very large but not keel-like, usually much shorter than caudal fin (except in the genus Gogolia); first dorsal base well ahead of pelvic bases, usually closer to pectoral bases than to pelvics but sometimes slightly closer to pelvics; midpoint of first dorsal base always in front of pelvic origins; pectoral fins with radials confined to bases of fins; ventral caudal lobe varying from absent to well-developed; no undulations or ripples in dorsal caudal margin. Neurocranium with supraorbital crests; vertebral centra with strong, wedge-shaped intermedial calcifications. Valvular intestine with a spiral valve of 4 to 11 turns. Some species with variegated colour patterns, most without them.

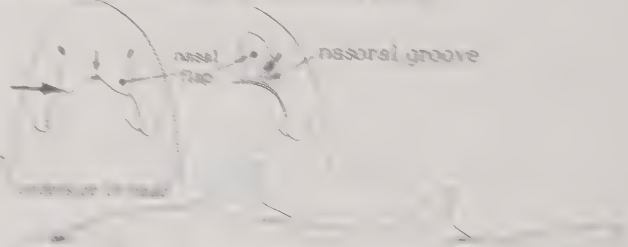
Habitat, Distribution and Biology: This is one of the larger families of sharks, with many species found in all warm and temperate coastal seas. Most species occur in continental and insular waters from the shoreline and intertidal to the outermost shelf, often close to the bottom, but a few deepwater species range down the continental slopes to considerable depths, possibly to over 2000 m (Iago omanensis). None of the species are oceanic, but many are found in sandy, muddy and rocky inshore habitats, including enclosed bays, and one species occurs on coral reefs. Although a few species have been recorded from up river mouths, none can apparently tolerate fresh water for extended periods. Most houndsharks are fairly strong swimmers and occur in small to large schools or singly. Some very active species, like the tope shark (Galeorhinus) may swim more or less continuously, but species of Mustelus and Triakis can rest on the bottom; some species are more active at night than the day. A few houndsharks may reach 2 m length, but most are smaller and some mature at about 35 cm. Many are more active at night than the day, and many tend to habitually swim close to the bottom. The species are variably ovoviviparous or viviparous, and lack or have a yolk sac placenta, litters of young from 1 or 2 to 52. Houndsharks feed primarily on bottom and midwater invertebrates and bony fishes, with some species taking largely crustaceans, some mainly fishes, and a few primarily cephalopods. None eat mammalian meat or garbage to any extent. None of the species are particularly dangerous to people.

Interest to Fisheries: Genera of especial importance to fisheries include the temperate-water Galeorhinus (tope, soupfin, school, and vitamin sharks) and the temperate to tropical Mustelus (smooth hounds and gummy sharks), but members of the genera Triakis, Hemitriakis, Furgaleus, and Iago are also taken to some extent. Most of these sharks are fairly common to very abundant in coastal waters where they occur, are relatively small, and hence are very important to small commercial and artisanal fisheries that are limited in gear and movement, as well as to sports fisheries. Houndsharks are caught with line gear, bottom and floating gillnets, set bottom nets, bottom trawls, and sportsfishing gear. They are primarily utilized for their meat, but also for liver oil, for processing into fishmeal, and for shark-fin soup base.

Remarks: The arrangement of this family follows the revisions of Compagno (1970, 1979).

Key to Genera:

1a. Anterior nasal flaps very large, nearly meeting each other at midline of snout and overlapping mouth posteriorly. Nasoral grooves present (Fig. 1) .... Scylliogaleus

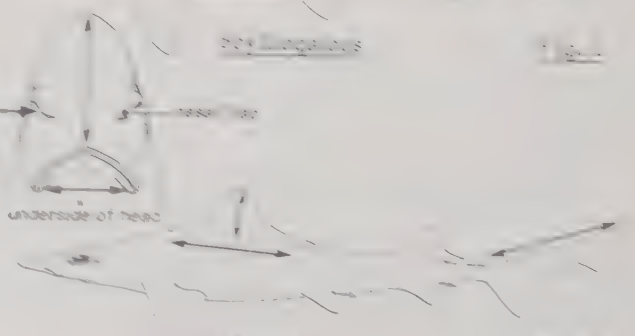


Scylliogaleus Fig. 1

1b. Anterior nasal flaps moderately large to very small, well separated from each other and not reaching mouth. No nasoral grooves

2a. First dorsal base about as long as caudal fin and 2.3 to 3.2 times the first dorsal height. Preoral length about 1.6 to 1.7 times mouth width (Fig. 2) .... Gogolia

2b. First dorsal base 0.7 times or less in length of caudal fin and 2 times or less the first dorsal height. Preoral length 0.7 to 1.4 times mouth width



Gogolia Fig. 2

3a. Anterior nasal flaps formed into slender barbels (Fig. 3) .... **Furgaleus**

3b. Anterior nasal flaps not barbel-like

4a. Ventral caudal lobe very long at all stages. Second dorsal fin markedly smaller than first, half its area or less

5a. Mouth angular. Second dorsal fin considerably larger than anal. Terminal lobe of caudal about a third of dorsal caudal margin length (Fig. 4) .... **Hypogaleus**

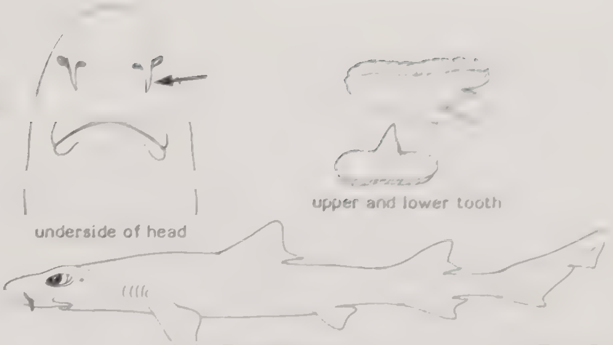
5b. Mouth broadly arched. Second dorsal fin about as large as anal. Terminal lobe of caudal about half of dorsal caudal margin length (Fig. 5) .... **Galeorhinus**

4b. Ventral caudal lobe absent to short in adults, weak or absent in young. Second dorsal nearly or quite as large as first, two-thirds to about equal its area

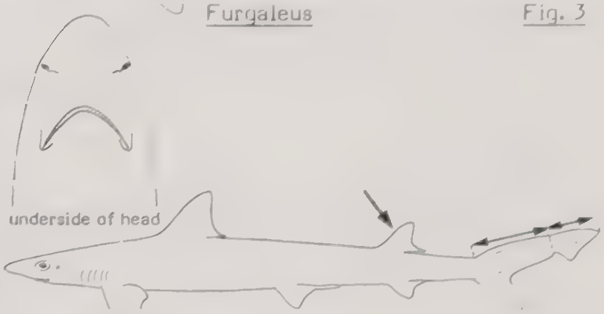
6a. Eyes lateral, subocular ridges obsolete (Fig. 6a). Origin of first dorsal far anterior, over pectoral bases (Fig. 7) .... **Iago**

6b. Eyes dorsolateral, subocular ridges strong (Fig. 6b). Origin of first dorsal more posterior, over or behind pectoral inner margins (Figs 8,9,10)

7a. Internarial width about 2.5 times the nostril width. Teeth strongly compressed and blade-like, differentiated into medials at symphyses of both jaws and anteroposteriors adjacent to them (Fig. 8) .... **Hemitriakis**


underside of head
upper and lower tooth

Furgaleus Fig. 3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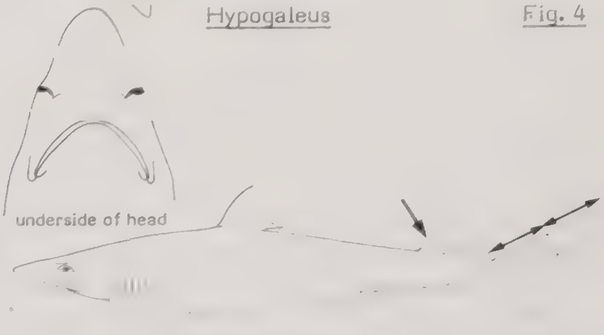
Hypogaleus Fig. 4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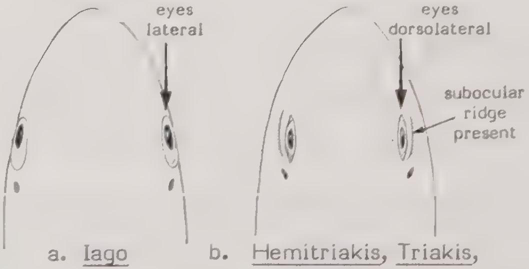
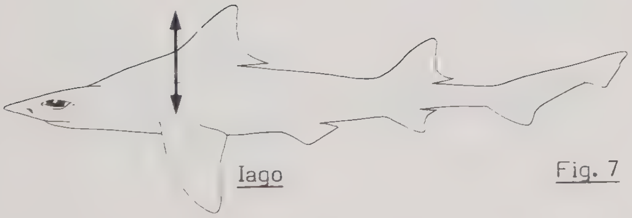
Galeorhinus Fig. 5

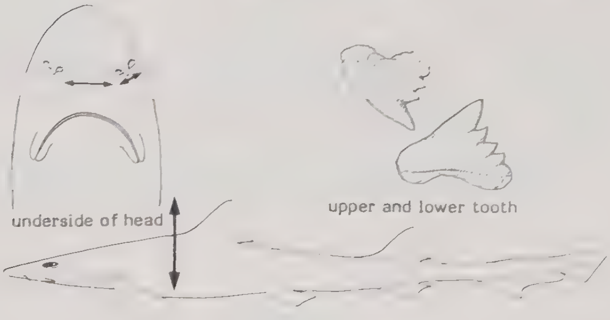

eyes
lateral
eyes
dorsolateral
subocular
ridge
present

a. Iago b. Hemitriakis, Triakis, Mustelus

dorsal view of head Fig. 6



Iago Fig. 7

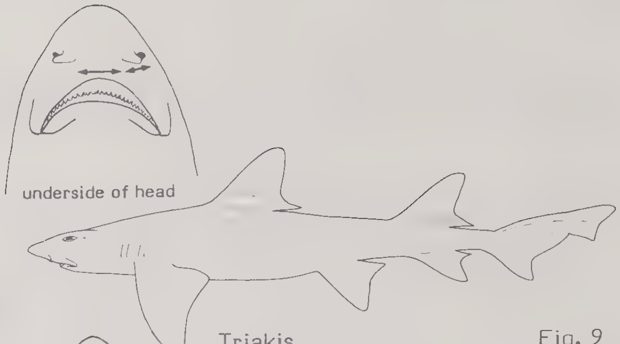

underside of head
upper and lower tooth

Hemitriakis Fig. 8

7b. Internarial width 1 to 2 times nostril width. Teeth broad and blunt to semi-bladelike, not strongly compressed, not differentiated into medials and anteroposteriors

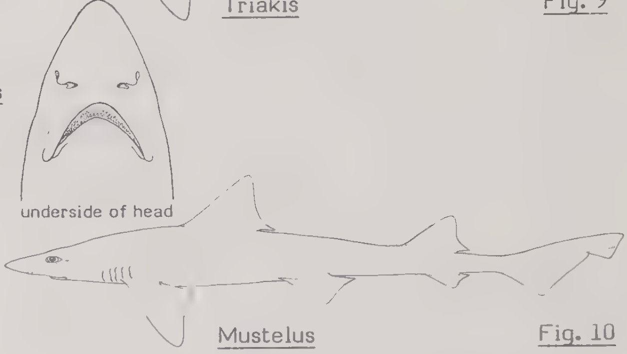
8a. Snout bluntly rounded in dorsoventral view. Mouth arcuate, lower jaw with convex edges (Fig. 9) .... **Triakis**

8b. Snout parabolic to subangular in dorsoventral view. Mouth angular, lower jaw with straight or nearly straight edges (Fig. 10) .... **Mustelus**



Triakis

Fig. 9



Mustelus

Fig. 10

Furgaleus Whitley, 1951

TRIAK Furg

Genus : Furgaleus Whitley, 1951, Proc.Roy.Zool.Soc.New South Wales, (1949-1950):67.

Type Species : Fur macki Whitley, 1943, by original designation.

Synonymy : Genus Fur Whitley, 1943 (junior homonym of Genus Fur Jones, 1940, in Insecta).

Diagnostic Features : Snout short and broadly rounded or wedge-shaped in dorsoventral view, preoral length about equal to mouth width; eyes horizontally elongated and dorsolateral, strong subocular ridges present below eyes; anterior nasal flaps formed as narrow, elongated barbels, well separated from each other and mouth; no nasoral grooves; internarial width 1.3 to 1.7 times nostril width; mouth broadly arched and short; labial furrows moderately long, uppers reaching anteriorly to level of upper symphysis; teeth bladelike, compressed, and cuspidate, well-differentiated in jaws, upper anteroposterior teeth with oblique cusps and cusplets, lowers with erect cusps and without cusplets; small medial teeth differentiated from larger anteroposterior teeth. First dorsal moderately large, base less than 2/3 length of dorsal caudal margin, its origin well behind pectoral free rear tips, midbase closer to pelvic bases than pectorals; second dorsal about as large as first; anal fin much smaller than second dorsal; ventral caudal lobe weak in young but short and strong in adults; terminal lobe of caudal fin short and 2.5 to 4 times in dorsal caudal margin.

Remarks : Furgaleus was proposed as a replacement name for Fur Whitley, 1943. Two species, F. macki and F. ventralis, have been proposed, but these are apparently synonyms (Compagno, 1979).

Furgaleus macki (Whitley, 1943)

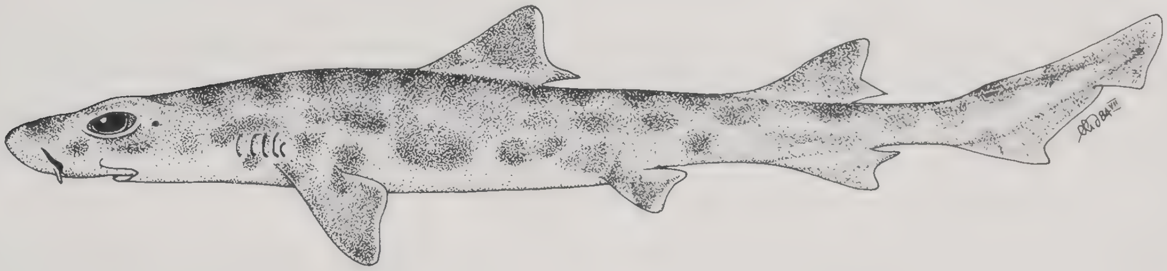
TRIAK Furg 1

Fur macki Whitley, 1943, Aust.Zool. 10(2):168, fig. 1. Holotype: Australian National Museum, Melbourne, R. 13258, 500 mm immature male. Type Locality: Mordialloc, Victoria, Australia.

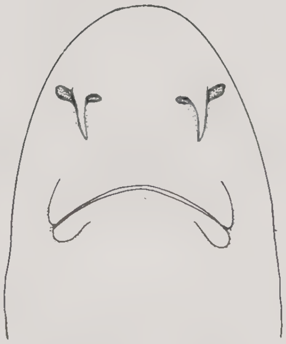
Synonymy : Fur ventralis Whitley, 1943.

Other Scientific Names Recently in Use : Furgaleus ventralis (Whitley, 1943).

FAO Names : En - Whiskery shark; Fr - Emissole moustachue; Sp - Cazón bigotudo.



Field Marks : A moderate-sized, stocky, almost hump-backed houndshark, with anterior nasal flaps formed into slender barbels, nictitating eyelids, eyes dorsolateral and above prominent subocular ridges, mouth arcuate and very short, labial furrows long and reaching level of upper symphysis, teeth compressed, bladelike but well-differentiated in jaws, uppers with oblique cusps and distal cusplets, lowers with erect cusps and no cusplets, dorsal fins about equal-sized and larger than anal fin, first dorsal much shorter than caudal fin, and colour grey above and light below, with dark saddles in young and some adults.



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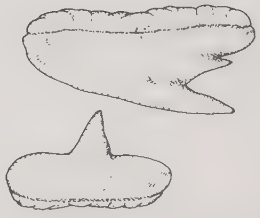
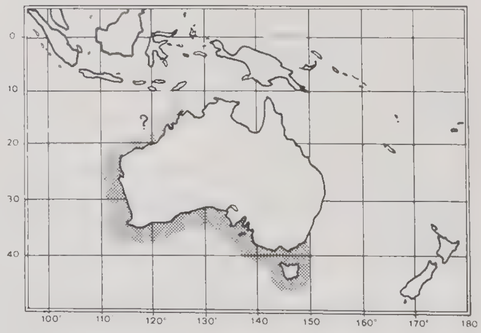


upper and lower tooth

Diagnostic Features : See genus.

Geographical Distribution : Western South Pacific: Australia (Victoria, Tasmania, South and Western Australia).



Habitat and Biology : A common active shark of the temperate Australian continental shelf, found at moderate depths, on or near bottom; common on rock bottom and kelp beds. Ovoviviparous, without a yolk-sac placenta; number of young 9 to 11, and possibly up to 16 per litter. Eats octopi, squid, bony fishes and lobsters.

Size : Maximum 160 cm, adult males 109 to 135 cm, females 110 to 132 cm, size at birth about 20 cm.

Interest to Fisheries : Regularly fished off Western Australia, using line gear and presumably gillnets, and marketed fresh for human consumption.

Literature : Whitley (1943, 1943a, 1944, 1948, 1967); Stead (1963); Compagno (1979).

Galeorhinus Blainville, 1816

TRIAK Galeo

Genus : Subgenus Galeorhinus Blainville, 1816 (Genus Squalus Linnaeus, 1758), Bull.Soc.Philomat.Paris, 8:121.

Type Species : "Galeorhinus galeus Blainville, 1816", by subsequent designation of Gill (1862:402); a synonym of Squalus galeus Linnaeus, 1758.

Synonymy : Subgenus Galeus Cuvier, 1817 (Genus Squalus Linnaeus, 1758; junior homonym of Galeus Rafinesque, 1810 in Family Scyliorhinidae; and senior homonym of Galeus Leach 1818, which in turn is a junior synonym of Mustelus Linck, 1790); Genus Eugaleus Gill, 1864; Genus Notogaleus Whitley, 1943.

Diagnostic Features : Snout moderately long and parabolic in dorsoventral view, preoral length about equal to mouth width; eyes horizontally oval and lateral, subocular ridges obsolete; anterior nasal flaps vestigial, formed as small, low, angular points, well separated from each other and mouth; no nasoral grooves; internarial width over 2.5 times nostril width; mouth broadly arched and long; labial furrows moderately long, uppers ending well behind level of upper symphysis; teeth bladelike, compressed, and cuspidate, similar in upper and lower jaws, anteroposteriors with oblique cusps and cusplets; medial teeth well differentiated from anteroposteriors. First dorsal fin moderately large, base half length of dorsal caudal margin or less; its origin over or slightly behind pectoral free rear tips, its midbase slightly closer to pectoral bases than pelvics; second dorsal much smaller than first, less than half height of first; anal fin about as large as second dorsal; ventral caudal lobe strong in young and adults; terminal lobe of caudal fin long and about 2 times in dorsal caudal margin.

Remarks : The scope of this genus follows the revisions of Compagno (1970, 1973b, 1979). Eugaleus omanensis Norman, 1939, Galeus japanicus Müller & Henle, 1839, Eugaleus hyugaensis Miyosi, 1939, and Galeorhinus (Hypogaleus) zanzibariensis Smith, 1957 are here included in the genera Iago (omanensis), Hemitriakis (japanicus), and Hypogaleus (hyugaensis and zanzibariensis). Other than these species, several species of true Galeorhinus have been recognized for different geographic regions: G. rhinophanes (Peron, 1807) or G. australis (Macleay, 1881) from Australia and New Zealand; G. zyopterus (Jordan & Gilbert, 1883) for the eastern North Pacific; G. chilensis (Perez Canto, 1886) for Peru and Chile; G. vitaminicus de Buen, 1950 from the eastern South Atlantic; and G. galeus from the eastern Atlantic. Comparison of accounts and specimens of these regional species of Galeorhinus indicated that they probably are not separable and should be placed in a single species (Compagno, 1979), possibly subdivided into subspecies. The eastern North Pacific Galeorhinus averages slightly more vertebrae and apparently matures at a somewhat larger size than other Galeorhinus, but is otherwise very similar to them. All the nominal species of Galeorhinus are included here under Galeorhinus galeus.

Galeorhinus galeus (Linnaeus, 1758)

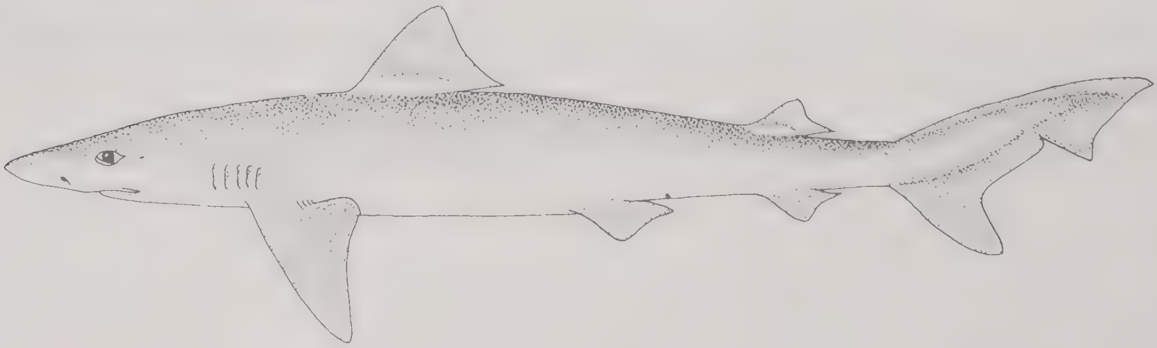
TRIAK Galeo 1

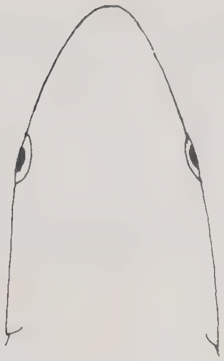
Squalus galeus Linnaeus, 1758, Syst.Nat., ed. 10, 1:234. Holotype: Unknown. Type Locality: "Habitat in Oceano Europae".

Synonymy : ? Squalus rhinophanes Peron, 1807; Galeus vulgaris Fleming, 1828; Galeus canis Bonaparte, 1834 (not Squalus canis Mitchell, 1815, = Mustelus canis); Galeus nilssoni Bonaparte, 1846; Galeus communis Owen, 1853; Galeus linnei Malm, 1877; Galeus australis Macleay, 1881; Galeus zyopterus Jordan & Gilbert, 1883; Galeus chilensis Perez Canto, 1886; Galeus molinae Philippi, 1887; Carcharhinus cyrano Whitley, 1930; Galeorhinus vitaminicus de Buen, 1950.

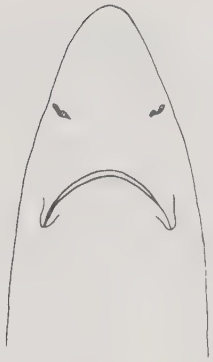
Other Scientific Names Recently in Use : Notogaleus rhinophanes (Peron, 1807); Galeorhinus australis (Macleay, 1881); Galeorhinus zyopterus (Jordan & Gilbert, 1883); Galeorhinus chilensis (Perez Canto, 1886).

FAO Names : En - Tope shark; Fr - Requin-hâ; Sp - Cazón.





dorsal view of head



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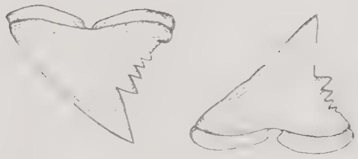
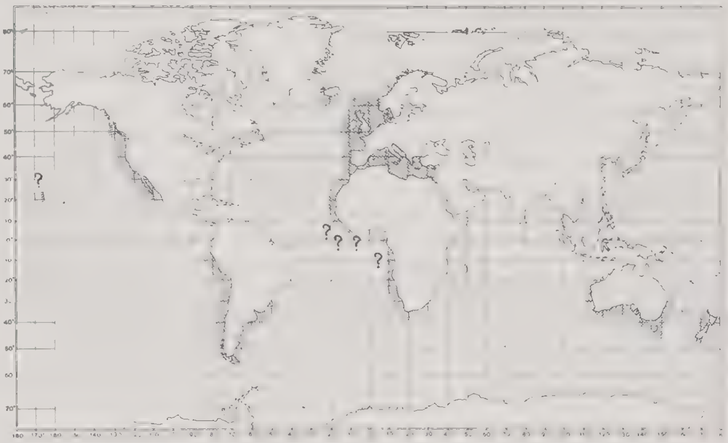


upper and lower tooth

Field Marks : A slender, long-nosed houndshark with vestigial anterior nasal flaps, large horizontally oval eyes with internal nictitating lower eyelids, subocular ridges obsolete, an arched mouth, moderately long upper labial furrows that fall short of lower symphysis, bladelike compressed teeth with oblique cusps and distal cusplets in both jaws, second dorsal fin much smaller than first and about as large as anal fin, and an extremely long terminal caudal lobe about half the dorsal caudal margin.

Diagnostic Features : See genus.

Geographical Distribution : Western South Atlantic: Southern Brazil to Argentina. Eastern Atlantic: Iceland, Norway, Faeroe Islands, British Isles to Mediterranean and Senegal, ? Ivory Coast, ? Nigeria, ? Gabon to Zaire, Namibia to South Africa. Western Indian Ocean: South Africa. Western South Pacific: Australia (Western and South Australia, Victoria, Tasmania, New South Wales, southern Queensland), Lord Howe Islands, Chatham Islands, New Zealand. ? Central Pacific: Laysan Islands. Eastern Pacific: British Columbia to southern Baja California, Gulf of California; Peru and Chile.



Habitat and Biology : An active, strong-swimming, abundant, coastal-pelagic species of temperate continental and insular waters, often found well offshore (but not oceanic) as well as at the surfline, in shallow bays, and in submarine canyons; often occurs near the bottom, at depths of 2 to 471 m. It is best known and is very abundant in cold to warm temperate continental seas, and tropical records of the species (particularly off West Africa but also Laysan Island) need to be confirmed and may be based on some other species (off East Africa, possibly based on Hypogaleus hyugaensis). It apparently occurs in small schools that are highly migratory in higher latitudes in their range, in some places moving poleward during the summer and equatorially in the winter (European waters and the eastern North Pacific, and southern Australia in part), or into deeper offshore waters in winter longitudinally in other areas (southern Australia in part). They can move swiftly, up to 56 km per day, and have been recorded as moving 1600 km at sustained rates of 16 km a day.

At least in some areas there is pronounced partial segregation by size and sex. In Californian waters during the pre-second world war soupfin fisheries there was a gradiation from predominance of adult males to predominance of adult females from north to south, with equal numbers of both sexes off central California; exceptions included San Francisco and Tomales Bays in northern California, when used as pupping grounds by adult females along with more important southern California inshore areas. The largest males occurred in northernmost waters. Adult males favour deeper waters while females occur closer inshore. In Australian waters schools have been found to be narrowly size and sex related, with those of yearling juveniles ranging into more estuarine situations than older juveniles and adults (except for pupping females). Off southeastern Australia sharks increase in size frequency from east to west from eastern Bass Strait to South Australia, and also increase off southern Tasmania, indicating a gradiation of higher numbers of adults westward and southward.

Population dynamics of the school shark has been studied in great detail off southeastern Australia. These are throught to be a different stock or population from school sharks off Western Australia. In summary, pregnant females move into shallow, partly enclosed bays and estuaries in late spring and early summer, and depart after dropping their young to offshore feeding grounds. Most young of the year depart the pupping grounds in late summer and move offshore, but mostly return to the bays and estuaries of their birth the following spring; some juveniles may switch to adjacent bays and estuaries. Some juveniles may remain in an estuary for up to two years before departing. Juveniles two years old join schools of immature sharks that are inshore or offshore along the coast. Schools of adult sharks in late summer and winter move either to deeper waters at the edge of the continental shelf in the Bass Straits region, or to warm waters of South Australia and New South Wales; at the edge of the shelf copulation occurs. Adult sharks then travel southward and shoreward in the spring to converge along the coastlines, where they feed in schools that vary their composition of individuals. About half of all adult females in these schools may be pregnant during the breeding season, and these visit the pupping grounds to renew the cycle.

Ovoviviparous, without a yolk-sac placenta; number of young 6 to 52 per litter, increasing with the size of the mother and averaging greater in the eastern North Pacific soupfin (in which the size at maturity and maximum size is greater, mean about 35) than in Australian school sharks (28) or European topes (possibly less than 20). Australian school sharks are recorded as producing litters with more males than females (54:46), but in two-year-old juveniles the ratio of males to females is reversed, apparently from increased mortality of males for unknown reasons. In school sharks the growth rate is regular and apparently does not show much seasonal variation. Male Australian school sharks mature at over 8 years old and mate at about 9 years, while females mature at at least 11 years old and give birth when at least 12 years old; the life expectancy of a large female school shark is at least 22 years.

Preys heavily on bony fishes, taking a wide variety of bottom and schooling midwater fishes including pilchards, herring, sardines and other clupeids, anchovies, salmon, smelt (Osmeridae), Australian whitebait (Aplochitonidae), hake, cod, ling and other codlike fishes, midshipmen, flyingfish, barracouta (Gempylidae), mackeral and small tuna, barracuda (Sphyraenidae), croakers, wrasses, opaleyes (*Girella*), surf perches (Embiotocidae), damselfishes, gobies, kelpfish (Clinidae), sole, halibut and other flatfish, rockfish and scorpionfish, sculpins, sablefish, but also cephalopods (most importantly squid, but also octopi), marine snails, crabs, shrimp, lobsters, annelid worms, echinoderms, and uncommonly other chondrichthyians (ratfish, sharks and small stingrays and skates). Although primarily an opportunistic predator on moderate-sized bony fishes (taken alive), this shark readily feeds on some invertebrates; young sharks may take more invertebrate prey than adults, and in some areas crabs and squid may be important prey items. This shark is little inclined to scavage, however, judging from the virtual absence of garbage and meat from terrestrial and large marine mammals in its reported diet (unlike the largely sympatric spotted sevengill shark, *Notorynchus cepedianus*, which readily eats such fare), as well as its strong preference for very fresh fish or squid bait over slightly stale or even fresh-frozen bait presented on hooks.

Although moderately large and active, the tope shark has never been reported to attack people. It will, however, snap when captured and has sufficiently large teeth to invite respect. On the other hand, the main enemy of this shark is undoubtedly *Homo sapiens*, particularly through wanton slaughter of juvenile sharks by misguided sports and commercial fishermen and killing of pregnant females. Natural predators of this shark include more powerful predatory sharks found in temperate waters, such as the great white shark (*Carcharodon carcharias*) and possibly the spotted sevengill shark (*Notorynchus cepedianus*), and probably marine mammals. If not badly traumatized in capture this shark will readily survive in large aquaria as in the Port Elizabeth Oceanarium, South Africa.

Size : Maximum 195 cm (large females of the eastern North Pacific form); males maturing between about 120 and 170 cm and reaching a maximum of 155 to 175 cm, females maturing between about 130 and 185 cm and reaching a maximum of 174 to 195 cm (combined figures for Californian, South African and Australian *G. galeus*); young born at about 30 to 40 cm long.

Data from California soupfin sharks (Ripley, 1946) indicates that there is an allometric change in length/weight relationships in adult females but possibly not for males. Logarithmic length/weight curves given by Ripley (1946) indicate log Wt (lbs) = -5.573 + 3.2.70 log total length (cm) for female soupfin 40 to 149 cm but jumping to log Wt (lbs) = -7.490 + 4.156 log total length (cm) for females 150 cm and larger (N = 869); for males (N = 42) this is log Wt (lbs) = -5.411 + 3.186 log total length (cm). For males and immature females, weight increases at slightly more than the cube of the length, indicating a retention of the slim build of young sharks, but as females mature they become relatively stockier and grow at over the 4th power of their length. Olsen (1954), with a smaller sample (254) for females and larger one for males (278) suggested that for the Australian school shark there was no such change in females, but his plot of female length/weight relations (Olsen, 1954, fig. 3), suggests that females above 135 cm may be departing the curve calculated for all females (which is almost the same for that of males, Wt (lbs) = 4.86×10^{-6} total length exp 3.18; males, Wt (lbs) = 4.80×10^{-6} total length exp 3.17).

Interest to Fisheries : This species is an important shark for fisheries, especially off Uruguay and Argentina, California, and southern Australia, but it is also fished elsewhere where it occurs. Its meat is excellent for human consumption and is eaten fresh, fresh frozen, or dried salted; its liver contains oil that is extremely high in vitamin A; and its fins are used for sharkfin soup. It is caught with bottom and pelagic gillnets, bottom and pelagic longlines, bottom and pelagic trawls, and with hook-and-line. A large fishery for this species existed off California in the thirties and fourties, which peaked at 4186 tons landed in 1939 but declined with overfishing and the substitution of synthetic vitamin A for that extracted from shark liver oil. A very similar fishery existed off South Africa at about the same time as the Californian fishery, and went through a similar cycle of growth and collapse. Currently these sharks are the object of an expanding commercial and sports fishery for human food off California, but stocks are already showing some signs of depletion there. It is doubtful whether stocks off California have in recent years attained the size of those exploited before the second world war. Fisheries in Australia and New Zealand have been restricted or have collapsed due to findings of high mercury levels in school sharks caught there. Topes figure prominently in a South African fishery centred in Gans Bay, and are processed for vitamin oil, fins, and "biltong" or dried meat.

Topes are also a common and popular catch of sports anglers, being commonly taken by rod and reel particularly in the British Isles, off South Africa and California. This shark will fight actively when hooked, but is currently not considered a game fish by the International Game Fish Association.

Important Regional Names : Tope shark (British Isles); Vitamin shark (Uruguay and Argentina; Tiburón vitaminico); Soupfin shark (California to British Columbia, also South Africa); School shark (Australia and New Zealand).

Literature : Ripley (1946); Roedel & Ripley (1950); Olsen (1953); Compagno (1970, 1979); Miller & Lea (1972); Hart (1973); Bass, D'Aubrey & Kistnasamy (1975a); Wheeler (1978); Ayling & Cox (1982).

Gogolia Compagno, 1973

TRIAK Gog

Genus : Gogolia Compagno, 1973b, Proc.Calif.Acad.Sci., 39(19):383.

Type Species : Gogolia filewoodi Compagno, 1973, by original designation.

Synonymy : None.

Diagnostic Features : Snout very long and bell-shaped in dorsoventral view, preoral length 1.6 to 1.7 times the mouth width; eyes horizontally oval and dorsolateral, subocular ridges strong; anterior nasal flaps vestigial, formed as small, low, angular points, well separated from each other and mouth; no nasoral grooves; internarial width about 2 times nostril width; mouth very broadly arched and short; labial furrows moderately long, uppers reaching level of upper symphysis; teeth bladelike, compressed, and cuspidate, moderately differentiated in jaws, anteroposteriors with oblique cusps and cusplets, uppers with slenderer cusps and more cusplets than lowers; medial teeth well differentiated from anteroposteriors. First dorsal fin very large and sail-like, its base almost equal to length of dorsal caudal margin; its origin over or somewhat anterior to pectoral insertions, and its midbase equidistant between pectoral and pelvic bases or somewhat closer to pectorals; second dorsal smaller than first, about 2/3 as high as first; anal fin considerably smaller than second dorsal; ventral caudal lobe hardly developed in young but short and strong in adults; terminal lobe of caudal fin moderately long and about 3.1 to 3.8 times in dorsal caudal margin.

Remarks : See Compagno (1973b, 1979) for detailed accounts of the morphology and systematics of this genus.

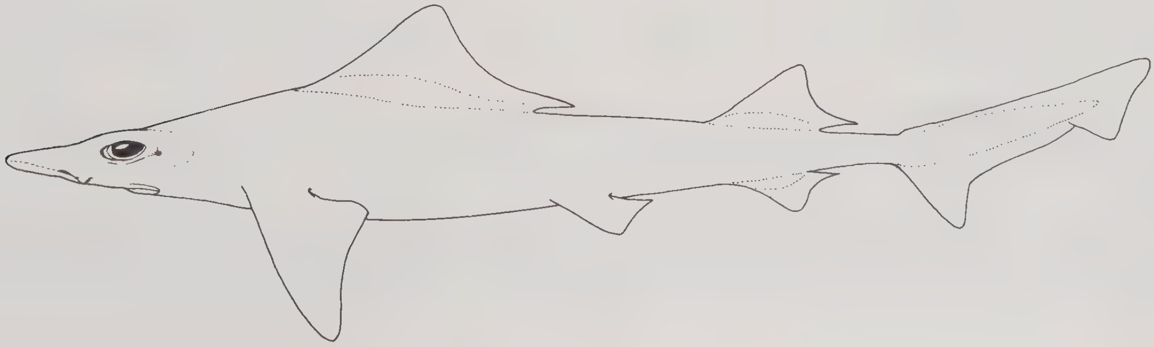
Gogolia filewoodi Compagno, 1973

TRIAK Gog 1

Gogolia filewoodi Compagno, 1973b, Proc.Calif.Acad.Sci., 39(19):394, figs 1-7. Holotype: Australian Museum, Sydney, AMS I.16858-001, 739 mm adult female with two fetuses (one in California Academy of Sciences, CAS-27588). Type Locality: Astrolabe Bay, northern New Guinea, about 1 mile north of the Gogol River mouth, ca. 5°18'S, 145°50'E, 73 m depth.

Synonymy : None.

FAO Names : En - Sailback houndshark; Fr - Requin-hâ voile; Sp - Cazón velero.

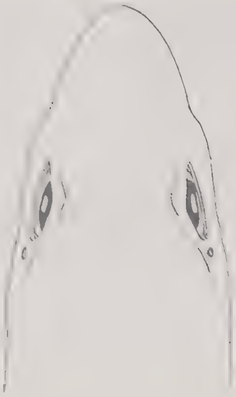


Field Marks : The huge, triangular, sail-like spineless first dorsal fin about as long as the caudal fin, the nictitating eyelids, the presence of an anal fin, and the long preoral snout 1.6 to 1.7 times the mouth width distinguish this small, grey-brown houndshark from all other species.

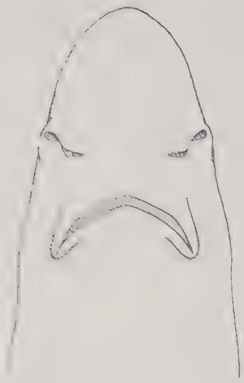
Diagnostic Features : See genus.

Geographical Distribution : Western South Pacific: Northern New Guinea.

Habitat and Biology : A little-known shark of the New Guinea continental shelf, the only specimen of which was taken at 73 m depth, probably near the bottom. Ovoviviparous, number of young 2 per litter.



dorsal view of head



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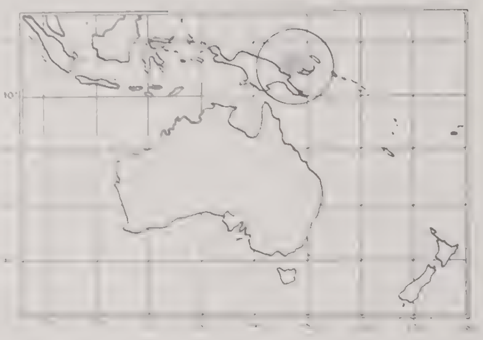
Size : Maximum 74 cm (adult female); size at birth at or near about 22 cm (fetuses of holotype full-term or nearly so).

Interest to Fisheries : None.

Literature : Compagno (1973b, 1979); Cadenat & Blache (1982).



Hemitriakis Herre, 1923

TRIAK Hem

Genus : *Hemitriakis* Herre, 1923, *Philipp.J.Sci.*, 23(1):70.

Type Species : *Hemitriakis leucoperiptera* Herre, 1923, by original designation.

Synonymy : None.

Field Marks : Slender houndsharks with rather long, parabolic snouts, dorsolateral eyes and strong subocular ridges, arched mouths, short anterior nasal flaps, small, wide-set nostrils, differentiated medial and bladelike anteroposterior teeth in both jaws, and second dorsal nearly as large as first.

Diagnostic Features : Snout moderately long and parabolic dorsoventral view, preoral length less than 1.3 times the mouth width; eyes horizontally elongated and dorsolateral, subocular ridges strong; anterior nasal flaps moderately elongated and lobate, well separated from each other and mouth; no nasoral grooves; internarial width about 2.5 to 2.8 times the nostril width; mouth broadly arched and moderately long; labial furrows moderately long, uppers nearly or quite reaching level of upper symphysis; teeth bladelike, compressed, cuspidate, and similar in both jaws, anteroposteriors with oblique cusps and cusplets; medial teeth well differentiated from anteroposteriors. First dorsal fin moderately large, its base less than 2/3 of dorsal caudal margin; its origin over pectoral inner margins or slightly behind their free rear tips, its midbase about equidistant between pectoral and pelvic bases or closer to pectoral bases; second dorsal nearly as large as first, height about 3/4 as high as first; anal fin considerably smaller than second dorsal; ventral caudal lobe hardly developed in young but short and strong in adults; terminal lobe of caudal fin moderately long and about 2.6 to 2.8 times in dorsal caudal margin.

Remarks : This genus was revived and revised by Compagno (1970, 1979). Previously *Hemitriakis* and *H. leucoperiptera* had been included in *Triakis* by Fowler (1941), which was followed by various writers. However, *H. japanica* had been placed in the genus *Galeorhinus* or its synonyms.

There may be a third species of *Hemitriakis* in Philippine waters, sympatric with *H. leucopteriptera*, but differing from it in coloration and fin proportions (Compagno, 1970, 1979). Additionally, a *Hemitriakis* very like *H. leucoperiptera* in shape but differing in having higher vertebral counts like *H. japanica* has been collected off northwestern Australia. This may be identical to *leucopteriptera* or new, but is certainly not *H. japanica*.

Key to Species:

1a. First dorsal origin about over or posterior to free rear tips of pectorals. Distance from pectoral free rear tips to pelvic origins greater than first dorsal length from origin to free rear tip. Total vertebral counts 154 to 165 .... *H. japanica*

1b. First dorsal origin over pectoral inner margins, anterior to their free rear tips. Distance from pectoral free rear tips to pelvic origins about as long as first dorsal. Total vertebral counts 133 to 146 .... *H. leucoperiptera*

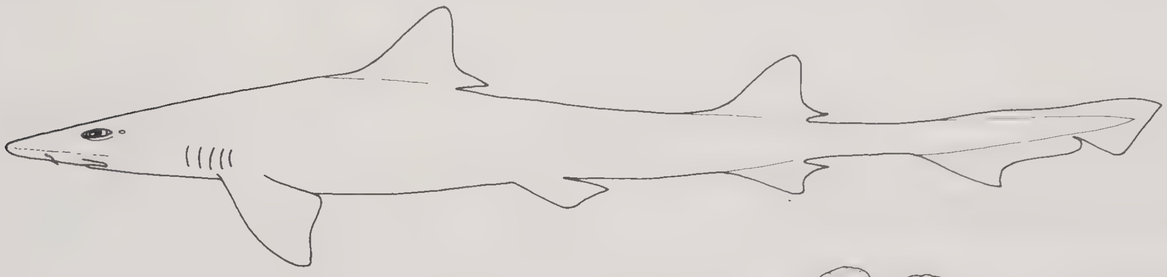
Hemitriakis japanica (Müller & Henle, 1839)

TRIAK Hem 1

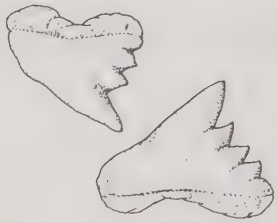
Galeus japanicus Müller & Henle, 1839, *Syst.Beschr.Plagiost.*, pt. 2:58, pl. 22. Holotype: In Rijksmuseum van Natuurlijke Historie, Leiden? Type Locality: Japan.

Synonymy: None.

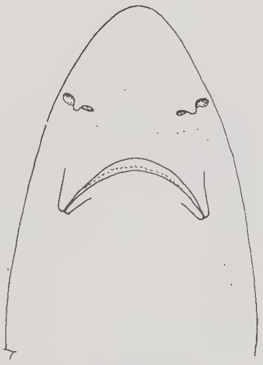
FAO Names: En - Japanese topeshark; Fr - Requin-hâ dochizame; Sp - Cazón japonés.



Field Marks: A houndshark with a moderately long parabolic snout, broadly arched mouth, eyes narrow, slitlike and dorsolateral, subocular ridges prominent, external nictitating lower eyelids present, nostrils with short, truncated anterior nasal flaps, internarial space over 2.5 times the nostril width, compressed teeth with oblique cusps and distal cusplets in both jaws, first dorsal somewhat longer than second but much shorter than caudal, first dorsal origin usually behind pectoral rear tips (except in newborn individuals), anal fin much smaller than first dorsal, fins with conspicuous white edges.



upper and lower tooth



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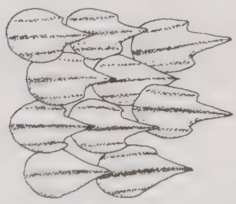
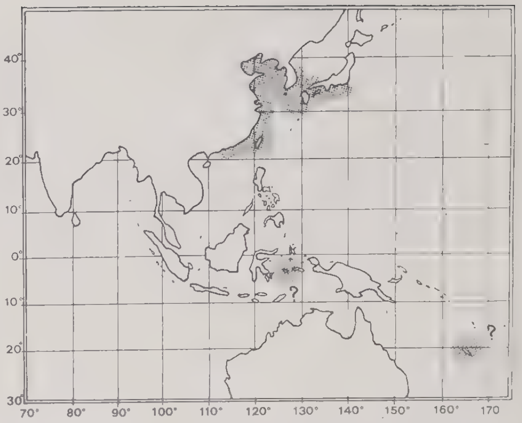


dermal denticles

Diagnostic Features: Eyes slitlike and narrowly elongated. Fins moderately falcate; first dorsal origin about over or posterior to free rear tips of pectoral; distance from pectoral free rear tips to pelvic origins greater than first dorsal length from origin to free rear tip. Total vertebral counts 154 to 165, monospondylous precaudal counts 39 to 43.



Geographical Distribution : Western Pacific: China, including Taiwan Island, the Koreas and Japan, and with some doubt from Amboina (Indonesia) and New Caledonia.

Habitat and Biology : A common continental temperate to subtropical shark in the western North Pacific, occurring close inshore and offshore down to at least 100 m depth.

Ovoviviparous, without a yolk-sac placenta. Number of young per litter 8 to 22 (mean 10), with about equal numbers per uterus and with the number increasing with size of female. In aggregates the sex ratio of embryos is 1:1, but individuals may have more of one sex than the other in left and right uteri and between one another. In the East China Sea mating takes place from June to September (mostly June to August) and birth season from June to August (mainly in June), with a gestation period of 10 months.

Presumably eats small fishes, cephalopods and crustaceans.

Size : Maximum size about 120 cm, males maturing at about 85 cm and reaching 110 cm, females maturing between 81 and 102 cm and reaching at least 120 cm; size at birth about 20 to 21 cm.

Interest to Fisheries : A common catch in Japanese, Korean, Taiwanese and probably Chinese waters. Caught with gillnets, bottom longlines, bottom trawls and set nets; meat used for human consumption.

Literature : Fowler (1941); Compagno (1970, 1979); Fourmanoir & Rancurel (1972); Chen & Mizue (1973).

Remarks : Records of this species from Amboina (Fowler, 1941) and New Caledonia (Fourmanoir & Rancurel, 1972) need confirmation, as an H. leucoperiptera-like shark has been taken off northwestern Australia and could very well be the basis of such records.

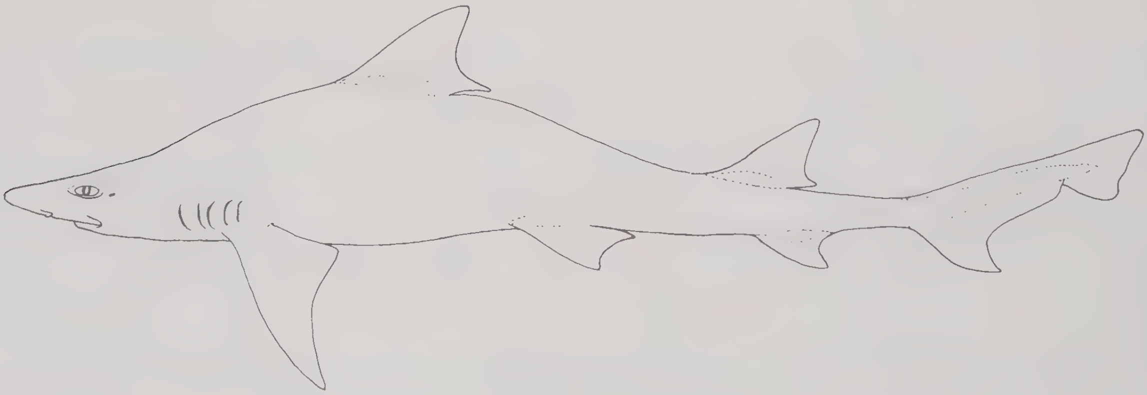
Hemitriakis leucoperiptera Herre, 1923

TRIAK Hem 2

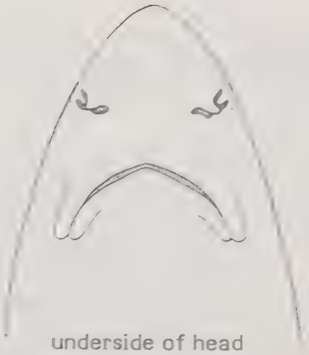
Hemitriakis leucoperiptera Herre, 1923, Philipp.J.Sci., 23(1):71, pl. 1. Holotype: Pregnant female of 955 mm, lost?. Type Locality: Dumaguete, Negros, The Philippines.

Synonymy : None.

FAO Names : En - Whitefin topeshark; Fr - Requin-hâ aile blanche; Sp - Cazón de aleta blanca.



Field Marks : A houndshark with a moderately long parabolic snout, broadly arched mouth, eyes moderately elongated and dorsolateral, subocular ridges prominent, external nictitating lower eyelids present, nostrils with short, truncated anterior nasal flaps, internarial space over 2.5 times the nostril width, compressed teeth with oblique cusps and distal cusplets in both jaws, first dorsal somewhat larger than second but much shorter than caudal, first dorsal origin over pectoral inner margins, anal fin much smaller than first dorsal, fins with conspicuous white edges.



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Diagnostic Features : Eyes horizontally oval. Fins strongly falcate; first dorsal origin over pectoral inner margins, anterior to their free rear tips; distance from pectoral free rear tips to pelvic origins about as long as first dorsal. Total vertebral counts 133 to 146, monospondylous precaudals 34 to 35.

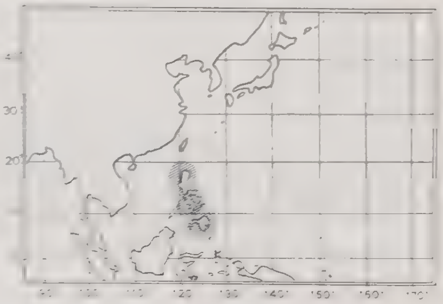
Geographical Distribution : Western North Pacific: The Philippines.

Habitat and Biology : A little-known inshore tropical shark, in Philippine coastal waters down to 48 m depth. Mode of development live-bearing, but it is not known if a yolk-sac placenta is formed; number of young 12 in a litter.

Size : Maximum 96 cm (pregnant female); size at birth at least 20 to 22 cm (term fetuses).

Interest to Fisheries : Presumably caught by local fisheries in the Philippines (the holotype was taken in a fish trap), but details are unknown.

Literature : Herre (1923, 1953); Compagno (1970, 1979).



Hypogaleus Smith, 1957

TRIAK Hypo

Genus : Subgenus Hypogaleus Smith, 1957c (Genus Galeorhinus Blainville, 1816), Ann.Mag.Nat.Hist.(Ser. 12), 10:585, 589.

Type Species : Galeorhinus (Hypogaleus) zanzibariensis Smith, 1957, by original designation; a junior synonym of Eugaleus hyugaensis Miyosi, 1939.

Synonymy : None.

Diagnostic Features : Snout moderately long and parabolic in dorsoventral view, preoral length about equal to mouth width; eyes horizontally oval and lateral, subocular ridges obsolete; anterior nasal flaps vestigial, formed as small, low, angular points, well separated from each other and mouth; no nasoral grooves; internarial width over 2.5 times nostril width; mouth angular and long; labial furrows moderately long, uppers ending well behind level of upper symphysis; teeth bladelike compressed, and cuspidate, similar in upper and lower jaws, anteroposteriors with oblique cusps and cusplets; medial teeth well differentiated from anteroposteriors. First dorsal fin moderately large, its base half length of dorsal caudal margin or less; its origin over or slightly behind pectoral free rear tips, its midbase somewhat closer to pectoral bases than pelvics; second dorsal considerably smaller than first, about 1/2 to 3/5 as high as first; anal fin considerably smaller than second dorsal; ventral caudal lobe strong in young and adults; terminal lobe of caudal fin moderately long and about 2.6 to 3 times in dorsal caudal margin.

Remarks : The subgenus Hypogaleus was raised in rank to genus by Compagno (1970) and subsequently recognized by Bass, D'Aubrey & Kistnasamy (1975b). The genus has a disjunct geographic distribution, in the western Indian Ocean off southeastern Africa and western North Pacific off Japan and Taiwan Island (Province of China), but this may be indicative of inadequate collecting in deeper continental waters between these extremes as well as the relative rarity of Hypogaleus individuals. Hypogaleus from the two areas have placed in separate species, H. hyugaensis (Miyosi, 1939) from Japan and H. zanzibariensis (Smith, 1957) from Tanzania, but there are no obvious differences between them and they have been tentatively synonymized (see Compagno, 1970, 1979, Bass, D'Aubrey & Kistnasamy (1975b).

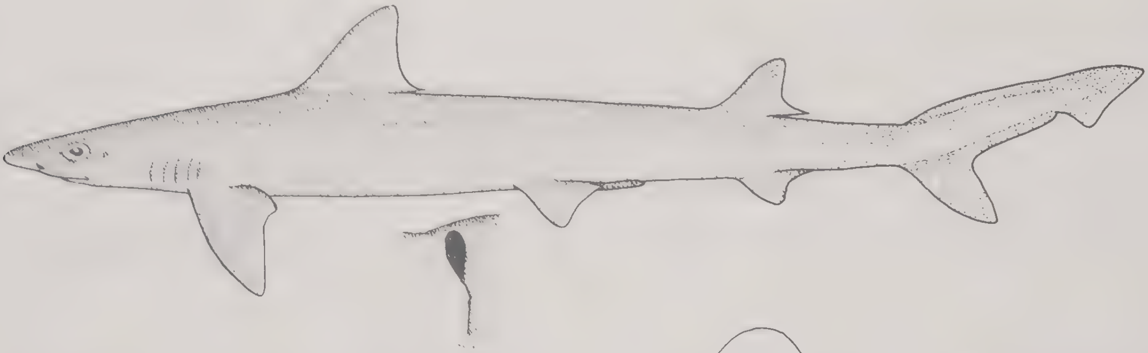
Hypogaleus hyugaensis (Miyosi, 1939)

TRIAK Hypo 1

Eugaleus hyugaensis Miyosi, 1939, Bull.Biogeogr.Soc.Tokyo, 9(5):91, fig. 1. Holotype: "Preserved at Matuyama Girl's High School of Matuyama City, Ehime Prefecture" (Miyosi, 1939), 904 mm female. Type Locality: Hyuga Nada, off east coast of Miyazaki Prefecture, Japan.

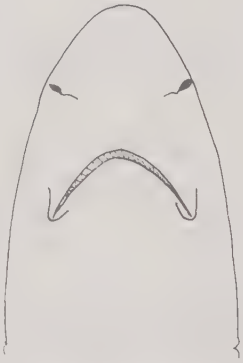
Synonymy : Galeorhinus (Hypogaleus) zanzibariensis Smith, 1957.

FAO Names : En - Blacktip tope; Fr - Requin-hâ élégant; Sp - Cazón elegante.



left nostril

Field Marks : A slender, moderately long-nosed houndshark with vestigial anterior nasal flaps, large horizontally oval eyes with internal nictitating lower eyelids, subocular ridges obsolete, an angular mouth, moderately long upper labial furrows that fall short of lower symphysis, bladelike compressed teeth with oblique cusps and distal cusplets in both jaws, second dorsal fin somewhat smaller than first but larger than anal fin, and a relatively short terminal caudal lobe much less than half the dorsal caudal margin.



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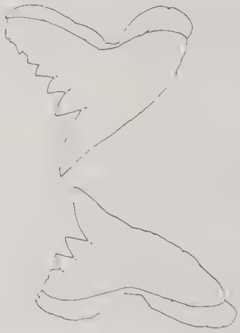


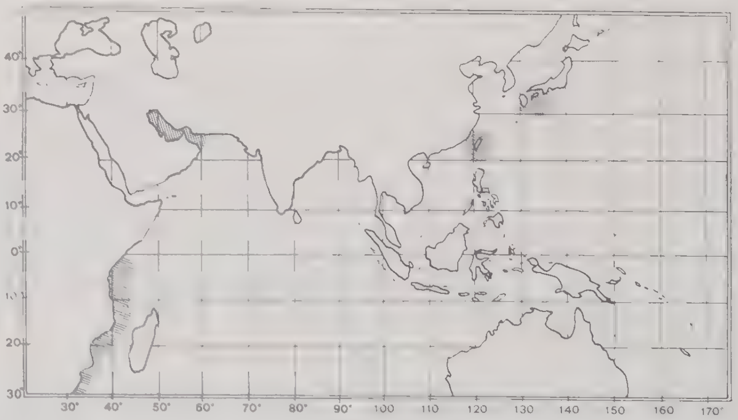
upper and lower tooth

Diagnostic Features : See genus.

Geographical Distribution : Western Indian Ocean: South Africa (Natal), Tanzania (Zanzibar), Kenya, the "Gulf". Western North Pacific: Taiwan Island (Province of China), Japan.

Habitat and Biology : A little-known, deepish water tropical and subtropical shark of the continental shelves found at 40 to 230 m depth near the bottom. Viviparous, with a yolk-sac placenta; number of young 10 or 11 to a litter. Gestation period estimated at 15 months with birth period in December in South African waters. Eats bony fishes.

Size : Maximum about 127 cm, adult males 112 to 127 cm, adult females 114 to 122 cm; full-term fetuses about 33 to 35 cm long.



Interest to Fisheries : A minor fisheries catch off Japan, probably taken in gillnets, line gear, and bottom trawls, and utilized for human consumption, but apparently uncommon and unimportant elsewhere.

Literature : Miyosi (1939); Smith (1957d); Teng (1962); Chen (1963); Compagno (1970, 1979); Bass, D'Aubrey & Kistnasamy (1975b).

Iago Compagno & Springer, 1971

Genus : Iago Compagno & Springer, 1971, Fish.Bull.NOAA/NMFS, 69(3):615, 616.

Type Species : Eugaleus omanensis Norman, 1939, by original designation.

Synonymy : None.

Field Marks : Rather slender houndsharks with lateral eyes and vestigial subocular ridges, angular mouths, first dorsal fin small but with origin far anterior over pectoral bases; second dorsal nearly as large as first, and ventral caudal lobe little developed.

Diagnostic Features : Snout moderately long and subangular in dorsoventral view, preoral length 0.7 to 1.4 times in mouth width; eyes horizontally oval and lateral, subocular ridges vestigial; anterior nasal flaps formed as low, rounded or angular lobes, well separated from each other and mouth; no nasoral grooves; internarial width about 1.4 to 2 times the nostril width; mouth angular and moderately long; labial furrows moderately long, uppers falling far short or nearly reaching level of upper symphysis; teeth bladelike, compressed, and cuspidate, hardly differentiated in jaws, anteroposteriors with oblique cusps and cusplets or blades; medial teeth well differentiated from anteroposteriors. First dorsal fin moderately large, its base half of dorsal caudal margin or less; its origin varying from over pectoral origins to over posteriormost thirds of pectoral bases; its midbase closer to pectoral bases than to pelvics; second dorsal fin somewhat smaller than first, its height 4/5 of first dorsal height or less; anal fin considerably smaller than second dorsal; ventral caudal lobe hardly developed at all sizes; terminal lobe of caudal fin moderately long and about 2.7 to 3.1 times in dorsal caudal margin.

Remarks : In addition to Iago omanensis and the recently described I. garricki, there are apparently additional species of Iago, from the Indian ocean and western Pacific. From the Gulf of Aden and southern India comes a low-finned Iago that is sympatric with I. omanensis but readily distinguishable from it, and may represent a new species. Very small adult male specimens of Iago from the Bay of Bengal are close to I. omanensis but may be distinct. There are Iago specimens from northwestern Australia that may be identical with I. garricki, but Iago material from the Philippines, although resembling I. garricki in many details, may also be new.

Key to Species :

1a. Snout rather short, preoral length 0.7 to 0.9 times in mouth width. Gill region greatly expanded, distance from spiracle to 5th gill slit greater than prespiracular head; width of longest gill slits nearly equal to eye length .... **I. omanensis**

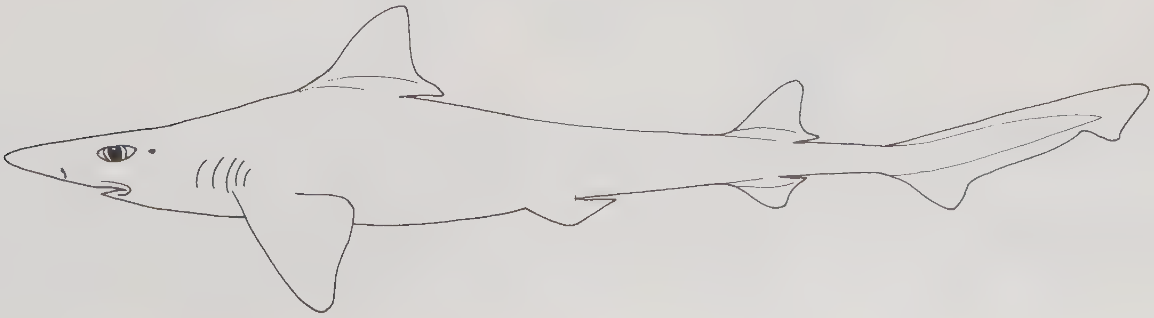
1b. Snout longer, preoral length about 1.1 times mouth width. Gill region not greatly expanded, distance from spiracle to 5th gill slit less than prespiracular head; width of longest gill slits much less than eye length .... **I. garricki**

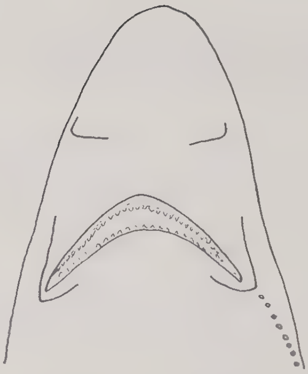
Iago garricki Fourmanoir & Rivaton, 1979

Iago garricki Fourmanoir & Rivaton, 1979, Cah.Indo-Pac., (4):434, fig. 22. Holotype: Museum National D'Histoire Naturelle, Paris, MNHN 1978-694, 620 mm female, possibly adult. Type Locality: Vate, New Hebrides, from 250 to 320 m depth.

Synonymy : None.

FAO Names : En - Longnose houndshark; Fr - Requin-hâ long nez; Sp - Cazón picudo.





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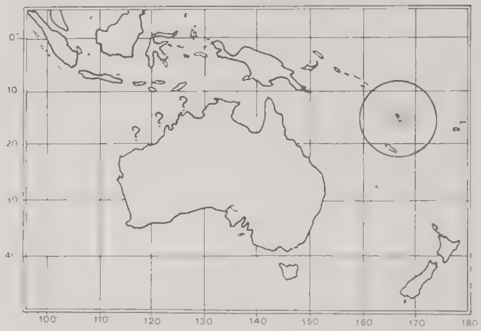
Field Marks: A houndshark with a long snout and short gill area, first dorsal small and with its origin far anterior, over the pectoral bases, and lateral eyes, with the subocular ridges obsolete.

Diagnostic Features: Snout rather long and narrow, preoral length about 1.1 times the mouth width; gill region not greatly expanded, distance from spiracle to 5th gill slit less than prespiracular head; width of longest gill slits much less than eye length; labial furrows rather long, uppers reaching level of lower symphysis. Ventral caudal lobe moderately expanded in adults. Dorsal fins with conspicuous black margins.

Geographical Distribution: Only known for certain from the type locality, Vate, New Hebrides, but specimens from northwestern Australia may be conspecific. A similar species, if not identical, occurs in the Philippines.



Habitat and Biology: A little-known, deepwater tropical shark of the New Hebrides uppermost insular slope, found at 250 to 320 m depth. Viviparous, with a yolk-sac placenta; number of young 4 or 5 per litter (2 or 3 per uterus). Eats cephalopods.

Size: Maximum 75 cm; adult females 62 to 65 cm; size at birth near 23 cm (size of full-term fetuses).

Interest to Fisheries: None at present.

Literature: Fourmanoir & Rivaton (1979).

Remarks: Inadequately described but undoubtedly distinct.

Iago omanensis (Norman, 1939)

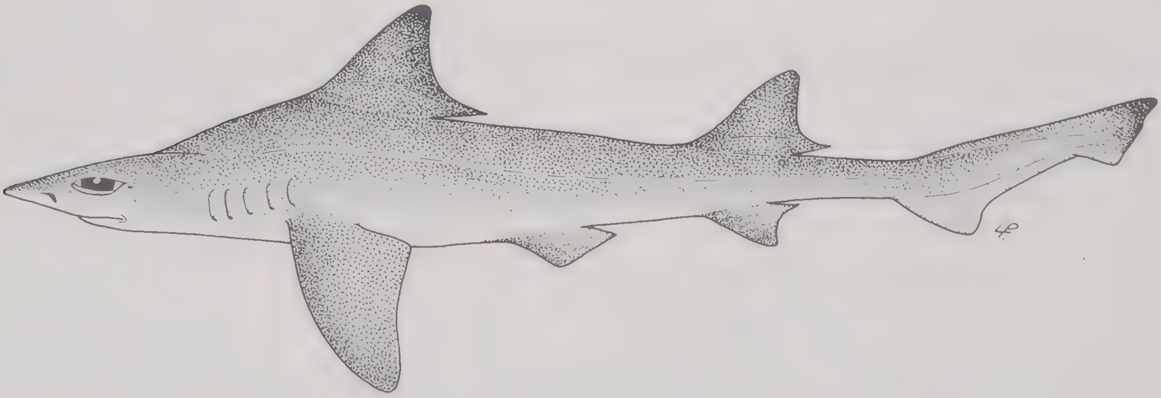
TRIAK Iago 1

Eugaleus omanensis Norman, 1939, *John Murray Exped.Sci.Rep.*, 7(1):11, fig. 3. Holotype: British Museum (Natural History), BMNH 1939.5.24.9, 280 mm immature female. Type Locality: Gulf of Oman, 210 m depth.

Synonymy: None.

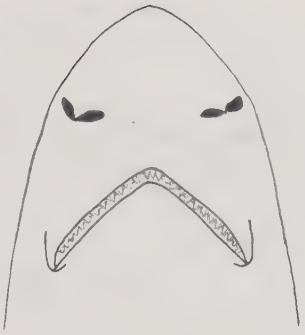
Other Scientific Names Recently in Use: *Galeorhinus omanensis* (Norman, 1939).

FAO Names: En - Bigeye houndshark; Fr - Requin-hâ à gros yeux; Sp - Cazón ojigrande.



Field Marks: A houndshark with a moderately long snout and long gill area, first dorsal small and with its origin far anterior, over the pectoral bases, lateral eyes with the subocular ridges obsolete, and ventral caudal lobe hardly developed.

Diagnostic Features: Snout rather short and moderately broad, preoral length about 0.7 to 0.9 times mouth width; gill region greatly expanded, distance from spiracle to 5th gill slit greater than prespiracular head; width of longest gill slits nearly equal to eye length; labial furrows shorter, uppers falling well behind level of lower symphysis. Ventral caudal lobe hardly expanded in adults. Colour brownish or greyish above and lighter below, with no conspicuous markings; margins of dorsal fins often somewhat darker.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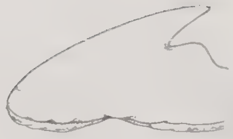
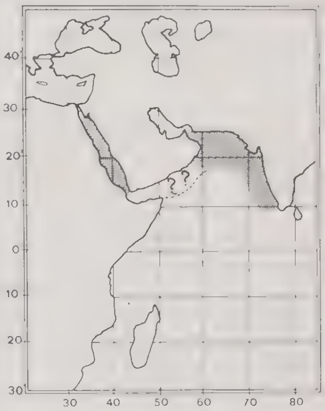

lower tooth

Geographical Distribution: Red Sea and Gulf of Oman to Pakistan and southwestern India. A low-finned, somewhat short-headed Iago is largely sympatric with I. omanensis at least off southwestern India, and in the Bay of Bengal there is a possibly dwarf, omanensis-like Iago that may or may not be distinct.



Habitat and Biology: A small, deepwater tropical shark of the continental shelf and slope from 110 m or less depth to at least 1000 m depth and possibly down to 2195 m in the Red Sea, on or near the bottom. This species has been regularly caught in warm water with oxygen levels often at a low level, at 16 to 25°C and 0.2 to 2.4 ml/l oxygen (mostly at 0.2 to 0.6 ml/l). Compared to I. garricki and the Philippine Iago, this species has an enlarged branchial region, with larger gill slits and expanded branchial septa with much greater expanses of gill lamellae; these are apparently adaptations for living in warm, relatively anoxic, and probably (especially in the Red Sea) hypersaline waters.

Viviparous, with a yolk-sac placenta; litter size probably about 2 to 10 young.

Definitely known to eat bony fishes and cephalopods. Nair & Appukuttan (1973) note that bony fishes, particularly lanternfishes, were the most important food item of this species off southern India, followed by deepwater squid, crustaceans (shrimp and larvae of mantis shrimp), bivalves and gastropods; sea grass and mud were found in a few stomachs. It is probable, however, that at least some of the Iago examined by these writers were not I. omanensis but its low-finned sympatriot (K.K. Appukuttan, pers.comm.).

Size: Maximum size 58 cm; adult males 30 to 37 cm, adult females 40 to 58 cm. Sexual dimorphism in size in this species is considerable, with the largest males about 63% as long as the longest female (37 versus 58 cm) and weighing about 1/6 as much (Compagno & Springer, 1971); size at birth at least 17 cm (A. Baranes, pers.comm., term fetuses).

Interest to Fisheries: Limited, taken in gillnet fisheries in southern India and also caught by handline fisheries in Israel in the Gulf of Aqaba (Elat). In India, utilized fresh for human consumption.

Literature: Compagno & Springer (1971); Nair & Lal Mohan (1973); Nair & Appukuttan (1973); Baranes & Ben-Tuvia (1979).

Mustelus Linck, 1790

TRIAK Must

Genus: Mustelus Linck, 1790, Mag.Neue.Phys.Naturges., Gotha, 6(3):31.

Type Species: Squalus mustelus Linnaeus, 1758, by subsequent designation of the International Commission of Zoological Nomenclature, Opinion 93 (1925:5).

Synonymy: Genus Mustellus Fischer, 1813 (emended spelling); Genus Galeus Leach, 1818 (junior homonym of Galeus Rafinesque, 1810 and Galeus Cuvier, 1817); Genus Emissola Jarocki, 1822; Genus Myrmillo Gistel, 1848; Genus Rhinotriacis Gill, 1863; Genus Pleuracromylon Gill, 1864; Genus Cynias Gill, 1903; Genus Murmille Setna & Sarangdhar, 1946; Genus Allomycter Guitart, 1972.

Field Marks: Usually slender houndsharks with long, parabolic subangular snouts, dorsolateral eyes and strong subocular ridges, angular mouths, teeth formed into a pavement, with cusps and cusplets variably developed but usually obsolete or absent, medial teeth not differentiated from anterolaterals, and second dorsal fin nearly as large as first.

Diagnostic Features: Snout long and parabolic-subangular in dorsoventral view, preoral length less than 1.3 times the mouth width. Eyes horizontally elongated or oval and dorsolateral, subocular ridges strong; anterior nasal flaps rather elongated and lobate, well separated from each other and mouth; no nasoral grooves; internarial width about 1 to 2 times the nostril width. Mouth angular and moderately long. Labial furrows moderately long, uppers falling well behind level of upper symphysis. Teeth not bladelike and similar in both jaws, varying from somewhat compressed and with short erect cusps and cusplets to rounded, molariform, and without cusps and cusplets; medial teeth not differentiated from anteroposteriors. First dorsal fin moderately large, its base less than 3/4 of dorsal caudal margin, its origin over pectoral inner margins or slightly behind their free rear tips, its midbase about equidistant between pectoral and pelvic bases or closer to pectoral bases; second dorsal nearly as large as first, its height about 2/3 to 3/4 as high as first; anal fin considerably smaller than second dorsal; ventral caudal lobe hardly developed in young but varying from poorly developed to short and strong in adults; terminal lobe of caudal fin moderately long and about 2.5 to 3 times in dorsal caudal margin.

Remarks: The arrangement of this genus is based on Heemstra's (1973, pers.comm.) revisions, from which much information on nomenclature, range, and size are taken. When preparing the account of Mustelus at the J.L.B. Smith Institute of Ichthyology, the author was able to freely utilize the knowledge and unpublished data of Dr P.C. Heemstra, for which he is very grateful; the writer suspects that the present section would have been far poorer without this help and information. Dr Heemstra intends to publish an updated version of his 1973 revision of the genus, in which five new species will be described, two in the western Atlantic, two in the tropical eastern Pacific, and one in tropical Australian waters and sympatric with Mustelus antarcticus. Revisionary works by Springer (1939), Bigelow & Schroeder (1940, 1948), and Kato, Springer & Wagner (1967) were also utilized.

The species of Mustelus (smooth-hounds, emissoles, palombos, tollos, gummy sharks, etc.) are abundant temperate to tropical, inshore bottom-dwelling sharks that figure prominently in artisanal and inshore commercial fisheries.

There have been a number of attempts to divide or subdivide Mustelus on mode of reproduction, but these have in general run afoul of the formerly confused generic nomenclature and of lack of knowledge on the reproduction of quite a number of species. Mustelus species are ovoviviparous (aplacental viviparous) or viviparous (placental viviparous or placentoviviparous), but it is not known if placental species have evolved more than once within the genus or if the aplacental species have secondarily evolved from placental species. If ovoviviparity is primitive within Mustelus, viviparity in the genus has evolved separately from that in other carcharhinoids. For further discussion of the taxonomic and nomenclatural aspects of reproduction in Mustelus, see Heemstra (1973) and Compagno (1979).

The genus Allomycter was described by Guitart (1972) for a species, A. dissutus, known only from photographs (type specimen lost). This was tentatively recognized by Compagno (1973a) but photographs of the species supplied later by Dr D. Guitart suggested that it was based on a Mustelus (probably M. canis) with an abnormal, possibly damaged or teratological snout (see Heemstra (1973) and Compagno (1979) for further discussion).

There has been considerable difficulty in the past with separating this genus from Triakis. See Kato (1968), Heemstra (1973), Bass, D'Aubrey & Kistnasamy (1975b), but especially Compagno (1970, 1973b, 1979) for discussion of this problem and its resolution.

Members of the genus Mustelus are unusually difficult to separate from one another, particularly without the use of internal characters. Many of the morphological, morphometric and meristic characters that distinguish species partially overlap and considerable variation occurs within species. The following key should be used with EXTREME CAUTION, as not every individual of a given species may fit the criteria given. A tentative identification made with the key should be carefully and thoroughly checked with the diagnostic features and the distribution for the species. As Mustelus species have limited geographic distributions a tentative identification of Mustelus lunulatus from, say, the western North Pacific is probably not that species but another, perhaps M. griseus. See Heemstra (1973) for regional keys to species.

Key to Species:

1a. Cusps high on teeth

2a. Fins without frayed posterior margins. Interorbital space broader, 5.1 to 6.2% of total length. Eye length 2.6 to 3.7 times in preorbital snout. Size small, maximum less than 70 cm (eastern Pacific) .... **M. dorsalis**

2b. Posterior margins of dorsal and occasionally caudal and anal fins with a dark margin of bare ceratotrichia which gives fins a frayed appearance. Interorbital space narrower, 3.9 to 5.6% of total length. Eye length less than 2.5 times in preorbital snout. Size larger, maximum about 90 cm

3a. Denticles usually tricuspidate. Internarial space moderate, 2.6 to 3.3% of total length. Interdorsal space greater, 19 to 24% of total length. Postanal space greater, 6.9 to 8.6% of total length (eastern Pacific) .... *M. henlei*

3b. Denticles lanceolate. Internarial space broader, 2.9 to 3.7% of total length. Interdorsal space less, 16 to 21% of total length. Postanal space less, 4.7 to 7.4% of total length (eastern Pacific) .... *M. whitneyi*

1b. Cusps low to absent on teeth

4a. No cusps on teeth, crowns broadly rounded

5a. Preorbital snout longer and more pointed, 9.4 to 10.2% of total length. Mouth wider, 6.7 to 7% of total length. Postanal space 4.2 to 5.6% of total length. Precaudal vertebrae 58 to 63. No white spots on body; vertical narrow dark bands present in adults (western South Atlantic) .... *M. fasciatus*

5b. Preorbital snout shorter and blunter, 6.9 to 9% of total length. Mouth narrower, 4.5 to 6.4% of total length. Postanal space 5.7 to 7.5% of total length. Precaudal vertebrae 64 to 90. Small white spots present on body; vertical dark bands present only in young (eastern South Pacific) .... *M. mento*

4b. Low blunt cusps present on teeth, crowns asymmetrical

6a. Numerous small white spots on dorsal surface of body, particularly along lateral line (sometimes absent). Upper labial furrows considerably longer than lowers

7a. Posterior margins of dorsal fins usually with a narrow dark margin of bare ceratotrichia. Internarial space very narrow, 1.8 to 2.4% of total length (western South Atlantic) .... *M. schmitti*

7b. Posterior margins of dorsal fins without bare ceratotrichia. Internarial space broader, 2.0 to 3.8% of total length

8a. Denticles covering anterior third of palate and floor of mouth. Interorbital averaging broader, 3.7 to 5.2 of total length

9a. Pelvic fins larger, anterior margins 7.2 to 8.7% of total length. Precaudal diplospondylous centra 50 to 60, precaudal centra 87 to 95 (New Zealand) .... *M. lenticulatus*

9b. Pelvic fins smaller, anterior margins 6.2 to 7.9% of total length. Precaudal diplospondylous centra 40 to 50, precaudal centra 76 to 86 (Australia) .... *M. antarcticus*

8b. Denticles covering entire palate and floor of mouth. Interorbital averaging narrower, 3.4 to 4.7% of total length

10a. Internarial space averaging broader, 2.4 to 3% of total length. Pectoral fins larger, posterior margin 12 to 16% of total length (southern Africa) .... *M. palumbes*

10b. Internarial space averaging narrower, 2 to 2.6% of total length. Pectoral fins smaller, posterior margin 7.5 to 14% of total length

11a. Precaudal diplospondylous centra 49 to 61, precaudal centra 90 to 100. Size larger, adults 78 to 140 cm (eastern North Atlantic and Mediterranean) .... *M. asterias*

11b. Precaudal diplospondylous centra 35 to 53, precaudal centra 72 to 92. Size smaller, adults 55 to 90 cm (Indo-West Pacific) .... *M. manazo*

6b. Dorsal surface uniform grey or with a few dark spots. Upper labial furrows usually about as long or hardly longer than lowers (noticeably longer in *M. canis* and to a lesser extent in *M. mustelus*)

12a. Posterior margins of dorsal fins usually with a narrow darker margin of bare ceratotrichia, giving the fins a frayed appearance. Internarial space narrower, 1.9 to 2.3% of total length. Usually a few small dark spots or blotches on dorsal surface of body (eastern North Atlantic and Mediterranean) .... **M. punctulatus**

12b. Posterior margins of dorsal fins without a narrow darker margin of bare ceratotrichia. Internarial space broader, 2.2 to 3.8% of total length. Usually no dark spots or blotches on dorsal surface of body (except for some M. mustelus)

13a. Crowns of lateral trunk denticles tricuspidate. Interorbital rather broad, 4.5 to 6.3% of total length. Size small, adults 43 to 64 cm (western Atlantic) .... **M. higmani**

13b. Crowns of lateral trunk denticles usually lanceolate (variably tricuspidate or lanceolate in M. mosis). Interorbital narrower, 3.3 to 4.6% of total length. Size larger, adults 57 to 100 cm or more

14a. Upper labial furrows usually distinctly longer than lowers. Buccopharyngeal denticles usually covering anteriormost part of palate and tongue. Size larger, maturing at 70 to 80 cm and reaching at least 150 cm

15a. Internarial space broader, 2.7 to 3.6% of total length. Labial furrows somewhat longer, 1.6 to 2.7% of total length. Precaudal centra more numerous 85 to 100 (western Atlantic) .... **M. canis**

15b. Internarial space narrower, 2.4 to 3% of total length. Labial furrows somewhat shorter, 1.4 to 2% of total length. Precaudal centra fewer, 70 to 93 (eastern Atlantic, Mediterranean and Cape Coast of South Africa) .... **M. mustelus**

14b. Upper labial furrows subequal to or shorter than lowers. Buccopharyngeal denticles more extensive, extending nearly halfway to internal openings of fifth gill slits (condition uncertain in M. californicus and M. lunulatus). Size smaller, adults maturing at 58 to 70 cm and reaching 115 cm

16a. Mouth rather short, length about equal to eye length. First dorsal midbase somewhat closer to pelvic fins than pectorals. Ventral caudal lobe not expanded and falcate in adults or little falcate (eastern North Pacific) .... **M. californicus**

16b. Mouth longer, length usually greater than eye length. First dorsal midbase about equidistant between pectoral and pelvic fins. Ventral caudal lobe more or less expanded and falcate in adults

17a. Precaudal centra more numerous, 87 to 100 (western Atlantic) .... **M. norrisi**

17b. Precaudal centra less numerous, 59 to 81

18a. Lower labial furrows longer than uppers. Lateral trunk denticles with ridges extending two-thirds length of crown (eastern Pacific) .... **M. lunulatus**

18b. Upper and lower labial furrows usually subequal. Lateral trunk denticles with ridges extending entire length of crown

19a. Labial furrows longer, 1.3 to 2% of total length. Rostral cartilages and supraorbital crests hypercalcified in adults (Red Sea and western Indian Ocean) .... **M. mosis**

19b. Labial furrows shorter, 0.8 to 1.4% of total length. Cranium not hypercalcified (western Pacific) .... **M. griseus**

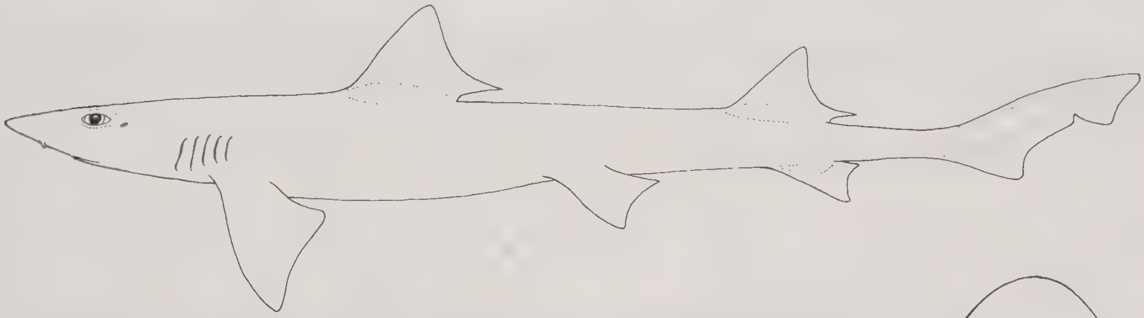
Mustelus antarcticus Günther, 1870

TRIAK Must 8

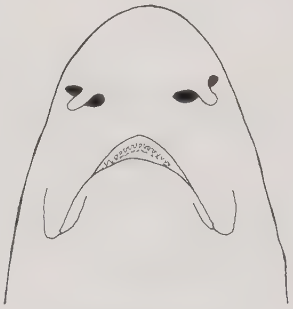
Mustelus antarcticus Günther, 1870, Cat.Fish.British Mus., 8:387. Syntypes: British Museum (Natural History), BMNH 1869.6.7.1, 870 mm female, New South Wales; BMNH 1868.8.18.5, 1030 mm adult male, Tasmania; an additional syntype, BMNH 1823.2.10.12, is not this species but M. lenticulatus (Heemstra, 1973). Type Locality: "South Pacific" (New South Wales, Tasmania, New Zealand).

Synonymy : Emissola maugeana Whitley, 1939; Emissola ganearum Whitley, 1945.

FAO Names : En - Gummy shark; Fr - Emissole gommée; Sp - Musola austral.



Field Marks : A white-spotted Mustelus with a broad internarial space, short head, low-cusped teeth, long upper labial furrows, dorsal fin margins not frayed, relatively small pectoral and pelvic fins, buccopharyngeal denticles confined to anterior end of mouth, and 76 to 86 precaudal centra. It is the only species of Mustelus in temperate Australian waters.



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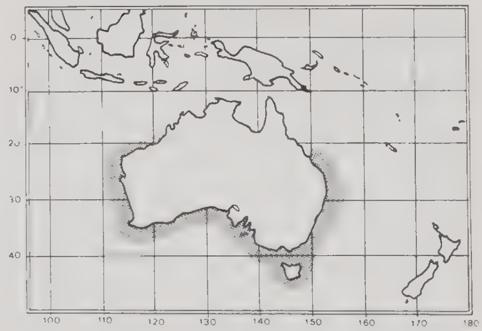
Diagnostic Features : Body fairly slender. Head short, prepectoral length 17 to 21% of total length; snout moderately long and bluntly angular in lateral view, preoral snout 5.7 to 7.4% of total length, preorbital snout 5.8 to 7.8% of total length; internarial space broad, 2.6 to 3.2% of total length; eyes fairly large, eye length 1.6 to 3.2 times in preorbital snout and 2.4 to 4.2% of total length; interorbital space fairly broad, 3.7 to 5.1% of total length; mouth short, its length subequal to eye length and 3.0 to 3.6% of total length; upper labial furrows considerably longer than lowers and 2.0 to 2.8% of total length; teeth molariform and asymmetric, with cusp reduced to a low point; buccopharyngeal denticles confined to tongue and anteriormost part of palate. Interdorsal space 19 to 23% of total length; trailing edges of dorsal fins denticulate, without bare ceratotrichia; pectoral fins moderately large, length of anterior margins 12 to 16% of total length, width of posterior margin 8 to 13% of total length; pelvic anterior margins 6.2 to 7.9% of total length; anal height 2.5 to 4.4% of total length; anal-caudal space greater than second dorsal height, 6.9 to 8.3% of total length; ventral caudal lobe more or less falcate in adults. Crowns of lateral trunk denticles lanceolate, with longitudinal ridges extending at least half their length. Cranium, hyomandibulae and scapulocoracoids not hypercalcified in adults; palatoquadrates not subdivided; monospondylous precaudal centra 35 to 38, diplospondylous precaudal centra 39 to 50, precaudal centra 76 to 86. Colour grey or grey-brown, above, light below, usually with numerous small white spots but without dark spots or dark bars. Development ovoviviparous. Size large, adults 68 to 157 cm.



Geographical Distribution : Western South Pacific: Australia (Western and South Australia, Victoria, Tasmania, New South Wales, southern Queensland).

Habitat and Biology : An abundant inshore and offshore shark of temperate waters, found on or near the bottom and from the intertidal to 183 m. Ovoviviparous, without a yolk-sac placenta, number of young 5 to 16 per litter. Eats crustaceans, including crabs, marine worms and small fishes.

Size : Maximum 157 cm, males maturing at about 68 cm, females at about 80 cm.

Interest to Fisheries : This small shark is widely fished in Australia, and utilized fresh for human consumption.

Literature : Whitley (1940, 1967); Stead (1963); Heemstra (1973 and pers. comm.).

Remarks : This species is closest to the New Zealand M. lenticulatus, but differs in having slightly larger pelvic fins and fewer precaudal vertebrae. The author follows Heemstra (1973) in synonymizing Emissola ganearum with this species. Dr P.C. Heemstra (pers. comm.) regards the larger Western Australian gummy sharks (E. ganearum) as conspecific with M. antarcticus, although he had previously (Heemstra, 1973) kept them as separate species following Whitley.

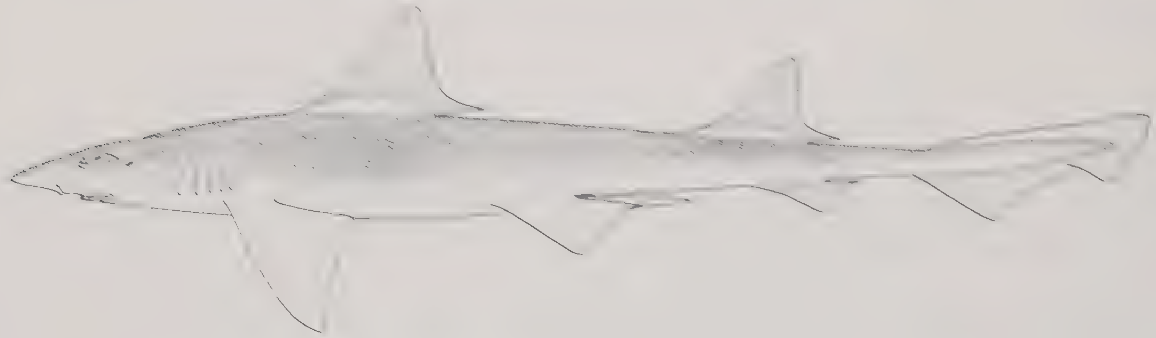
Mustelus asterias Cloquet, 1821

TRIAK Must 2

Mustelus asterias Cloquet, 1821, Emissole, in Dict.Sci.Nat., 14:401. Holotype: None. Type Locality: None mentioned.

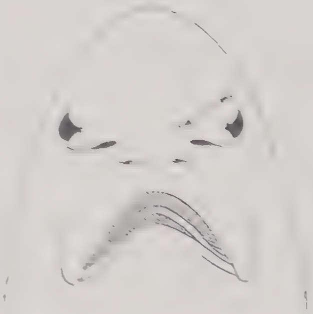
Synonymy : Squalus hinnulus Blainville, 1825; Mustellus stellatus Risso, 1826; Mustelus plebejus Bonaparte, 1834; Mustelus equestris Bonaparte (in part; also M. mustelus); Squalus albomaculatus Pucci, 1846; Squalus edentulus Doderlein, 1881.

FAO Names : En - Starry smooth-hound; Fr - Emissole tachetée; Sp - Musola estrellada.



Field Marks : A large, white-spotted Mustelus with a relatively narrow internarial space, buccopharyngeal denticles covering almost entire oral cavity, unfringed dorsal fins, relatively small pectoral and pelvic fins, and 90 to 100 precaudal centra. It is the only white-spotted smooth-hound in European waters.

Diagnostic Features : Body fairly slender. Head short, prepectoral length 13 to 17% of total length; snout moderately long and bluntly angular in lateral view, preoral snout 5.4 to 7.2% of total length, preorbital snout 5.7 to 7.2% of total length; internarial space fairly narrow, 2 to 2.6% of total length; eyes large, eye length 1.6 to 2.2 times in preorbital snout and 2.5 to 4.1% of total length; interorbital space relatively narrow, 3.4 to 4.5% of total length; mouth relatively short, subequal or smaller than eye length, its length 2.2 to 3.5% of total length; upper labial furrows considerably longer than lowers, upper furrows 1.8 to 2.5% of total length; teeth molariform and asymmetric, with cusp reduced to a low point, cusplets absent except in very young sharks; buccopharyngeal denticles covering entire palate and floor of mouth. Interdorsal space 19 to 25% of total length; trailing edges of dorsal fins denticulate, without bare ceratotrichia; pectoral fins moderate-sized, length of anterior margins 12 to 16% of total length, width of posterior margins 7.8 to 13% of total length; pelvic anterior margins 5.8 to 9.1% of total length; anal height 2.4 to 3.9% of total length; anal-caudal space usually greater than second dorsal height, 6.8 to 11% of total length; ventral caudal lobe not falcate in adults. Crowns of lateral trunk denticles broadly lanceolate, with longitudinal ridges extending at least half their lengths. Skeleton not hypercalcified in adults; palatoquadrates not subdivided; monospondylous precaudal centra 36 to 40, diplospondylous precaudal centra 49 to 61, precaudal centra 90 to 100. Colour grey or grey-brown above, light below, usually with numerous small white spots on sides and back, but without dark spots or dark bars. Development ovoviviparous. Size large, adults 80 to 140 cm.



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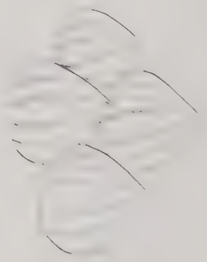
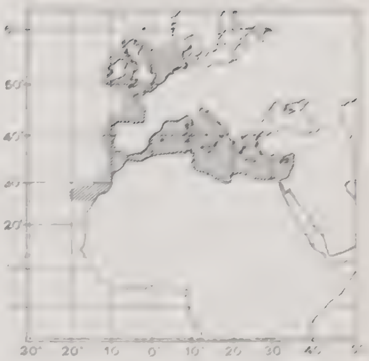


dermal denticles



Geographical Distribution: Eastern North Atlantic: British Isles and North Sea to Canary Islands, Mediterranean and Mauritania.

Habitat and Biology: A common inshore and offshore shark of the continental and insular shelves, on or near the bottom at depths from the intertidal down to at least 100 m. Prefers sandy and gravelly bottoms.

Ovoviviparous, without a yolk-sac placenta; number of young 7 to 15 per litter, with litter size proportionate to maternal size. The gestation period is about 12 months. Young are dropped inshore in summer, and presumably mating occurs in the same season. From growth-curve data it has been suggested that this species is fast-growing, maturing at an age of two to three years, but this has not been confirmed with direct ageing methods such as calibrating vertebral rings.

Primarily a crustacean feeder, that eats crabs, hermit crabs, lobsters and slipper lobsters. Hermit crabs are eaten complete with the whelk shells they live in and sometimes with the commensal sea anemones that live on their shells.

Size: Maximum about 140 cm, males maturing between 78 and 85 cm, females at about 85 cm; size at birth about 30 cm.

Interest to Fisheries: Caught by bottom trawls, line gear, and probably gillnets; utilized fresh and probably dried salted; also taken by shore anglers.

Literature: Lozano y Rey (1928); Springer (1939); Bigelow & Schroeder (1948); Tortonese (1956); Heemstra (1973); Wheeler (1978); Compagno (1981); Francis (1981).

Remarks: This species is very similar to other Eastern Hemisphere smooth-hounds with white spots and oviviviparous reproduction, including M. manazo, M. antarcticus, M. lenticulatus, and M. palumbes. All of these species are allopatric to M. asterias, but, according to Heemstra (1973 and pers. comm.), all are distinct if little-differentiated. M. manazo is most similar, but differs in being smaller and in having fewer vertebrae; M. lenticulatus and M. antarcticus have broader internarials and less extensive buccopharyngeal denticles; and M. palumbes has larger paired fins, a broader internarial, and somewhat fewer vertebrae. The white-spotted smooth-hounds from the Western Hemisphere, M. mento and M. schmitti, are very different from M. asterias and can be distinguished from it in the key to species.

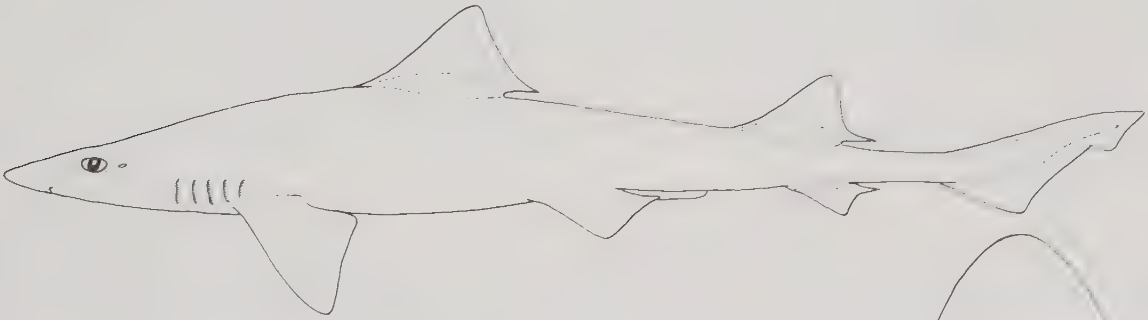
Mustelus californicus Gill, 1864

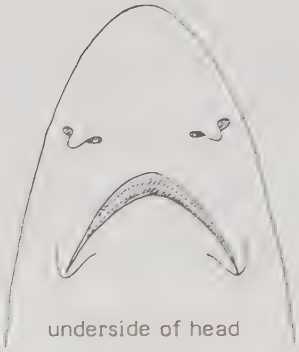
TRIAK Must 4

Mustelus californicus Gill, 1864, Proc.Acad.Nat.Sci.Philad., 16:148. Holotype: ?. Type Locality: San Francisco, California.

Synonymy: None.

FAO Names: En - Grey smooth-hound; Fr - Emissole grise; Sp - Musola gris.





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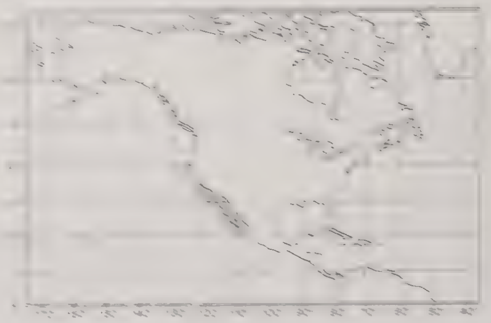
Field Marks: A spotless Mustelus with short head, broad internarial space, relatively small eye, narrow head, short mouth, upper labial furrows about equal to lowers, lanceolate lateral denticles with ridges incomplete when present, triangular dorsal fins, with the first dorsal closer to the pelvics than the pectorals, a poorly developed ventral caudal lobe, and 89 to 98 precaudal vertebral centra.

Diagnostic Features : Body fairly slender. Head short, prepectoral length 16 to 20% of total length; snout moderately long and bluntly angular in lateral view, preoral snout 7 to 7.2% of total length, preorbital snout 6.1 to 8% of total length; internarial space broad, 2.1 to 2.8% of total length; eyes fairly small, eye length 2.5 to 3.4 times in preorbital snout and 1.9 to 3.3% of total length; interorbital space narrow, 3.5 to 4.7% of total length; mouth short, subequal to eye length, its length 2.5 to 3.3% of total length; upper labial furrows usually equal to lowers, upper furrows 0.9 to 1.8% of total length; teeth molariform and asymmetric, with cusp reduced to a low point, cusplets absent; condition of buccopharyngeal denticles unknown. Interdorsal space 17 to 21% of total length; trailing edges of dorsal fins denticulate, without bare ceratotrichia; first dorsal broadly triangular to semifalcate with posteroventrally sloping or nearly vertical posterior margin, its midbase closer to pelvic bases than to pectorals; pectoral fins moderate-sized, length of their anterior margins 12 to 15% of total length, width of posterior margins 7.4 to 12% of total length; pelvic fins moderate-sized, length of anterior margins 7.1 to 9.2% of total length; anal height 2.3 to 3.7% of total length; anal-caudal space greater than second dorsal height, 5.9 to 8.6% of total length; ventral caudal lobe not falcate or somewhat falcate in adults. Crowns of lateral trunk denticles lanceolate, longitudinal ridges absent or extending about half of their entire length. Skeleton not hypercalcified in adults; palatine processes of palatoquadrates subdivided at symphysis, with a short separate medial segment on each side; monospondylous precaudal centra 32 to 40, diplospondylous precaudal centra 52 to 61, precaudal centra 89 to 98. Colour uniform grey above, light below, no white or dark spots or dark bars. Development viviparous. Size large, adults 57 to 124 cm.



Geographical Distribution : Eastern North Pacific: Northern California to Gulf of California.

Habitat and Biology : A common inshore and offshore warm-temperate to tropical bottom-dwelling shark of the continental shelves, entering shallow muddy bays. In north-central Californian waters in the USA it is primarily a summer visitor, but is resident in warmer waters from southern California south.

Viviparous, with a yolk-sac placenta; number of young 2 to 5 per litter.

Feeds mostly on crabs, including cancrids and grapsids, with the smaller grapsids being more important to younger sharks than larger ones, which eat more cancrids; also ghost shrimp, innkeeper (echiuroid) worms (Urechis), and small fish (herring and midshipmen, Porichthys) are occasionally taken. Burrowing invertebrates such as ghost shrimp and innkeeper worms are uncommon prey, indicating that this shark probably seldom roots out or sucks out such food, and may take only the stray individuals washed out of their burrows by the tide.

Size : Maximum about 124 cm, males maturing between 57 and 65 cm and reaching 116 cm; females maturing about 70 cm and reaching at least 124 cm.

Interest to Fisheries : Regularly caught by longline fisheries in the Gulf of California and utilized for human consumption; also caught by anglers in California.

Literature : Beebe & Tee-Van (1941); Roedel & Ripley (1950); Kato, Springer & Wagner (1967); Heemstra (1973); Talent (1982).

Remarks : According to Heemstra (1973), the holotype of this species was apparently lost. The holotype was said to have been collected at San Francisco, California, USA. As this species is not resident in the San Francisco area but is a summer visitor to the Monterey area, some 160 km south, Heemstra (1973) doubted the type locality of this species, and suggested that the holotype was collected in southern California. Another possibility suggests itself, that the specimen actually was taken at San Francisco, but was further north than the usual range of the species because of a warm water mass ('el Niño') moving up the coast.

In the southern part of its range this species is sympatric with M. lunulatus, but the latter can be distinguished by a broader interorbital, shorter mouth, often more falcate fins, shorter upper labial furrows, and fewer precaudal centra.

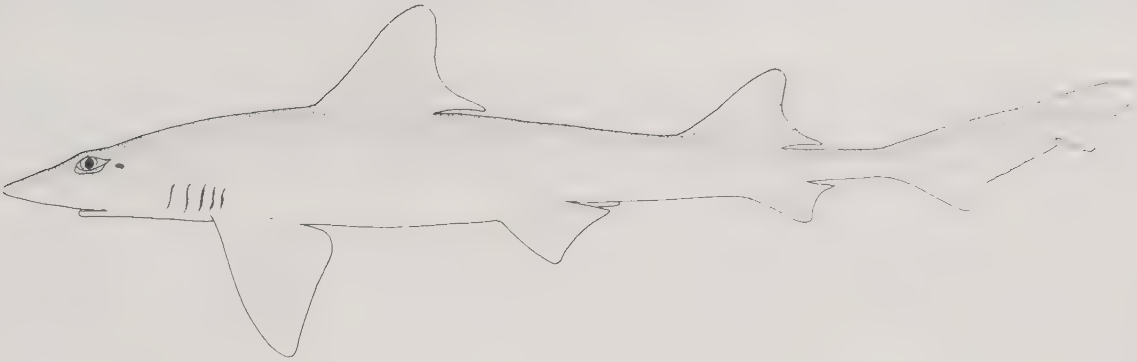
Mustelus canis (Mitchell, 1815)

TRIAK Must 3

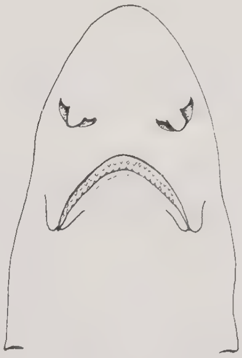
Squalus canis Mitchell, 1815, Trans.Lit.Philos.Soc.New York, 1:486. Holotype: ?. Type locality: New York.

Synonymy : Allomycter dissutus Guitart, 1972.

FAO Names : En - Dusky smooth-hound; Fr - Emissole douce; Sp - Musola dentuda.



Field Marks: An unspotted, large Mustelus with a short head and snout, broad internarial, large eyes, narrow interorbital, upper labial furrows somewhat longer than lowers, low-crowned teeth with weak cusps, buccopharyngeal denticles confined to extreme front of mouth, lateral trunk denticles usually lanceolate and with complete ridges, unfringed dorsal fins, 85 to 100 precaudal centra, and a non-falcate but moderately expanded ventral caudal lobe.



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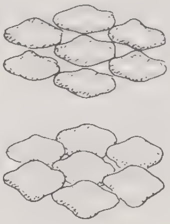
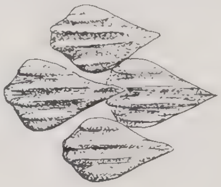


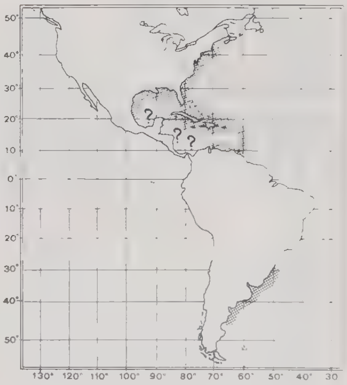
upper and lower teeth



dermal denticles

Diagnostic Features: Body fairly slender. Head short, prepectoral length 17 to 21% of total length; snout moderately long and bluntly angular in lateral view, preoral snout 5.5 to 8.1% of total length, preorbital snout 5.9 to 8.3% of total length; internarial space broad, 2.7 to 3.7% of total length; eyes fairly large, eye length 1.9 to 2.3 times in preorbital snout and 2.2 to 4.2% of total length; interorbital space narrow, 3.6 to 4.6% of total length; mouth fairly short, subequal to or slightly longer than eye length, its length 2.3 to 3.5% of total length; upper labial furrows slightly longer than lowers, upper furrows 1.6 to 2.7% of total length; teeth molariform and asymmetric, with cusp reduced to a low point, cusplets absent except in very young sharks; buccopharyngeal denticles confined to tongue and anteriormost part of palate. Interdorsal space 16 to 23% of total length; pelvic fins moderately large, anterior margin length 6.6 to 8.6% of total length; trailing edges of dorsal fins denticulate, without bare ceratotrichia; first dorsal somewhat falcate, with nearly vertical posterior margin, midbase closer to pectoral bases than to pelvics; pectoral fins moderately large, length of anterior margins 11 to 16% of total length, width of posterior margins 8 to 14% of total length; anal height 2.5 to 4.5% of total length; anal caudal space greater or subequal to second dorsal height, 6.3 to 9.2% of total length; ventral caudal lobe not falcate but somewhat expanded in adults. Crowns of lateral trunk denticles lanceolate, with longitudinal ridges extending at least half their length, and often their entire length. Skeleton not hypercalcified in adults; palatoquadrates not subdivided; monospondylous precaudal centra 34 to 42, diplospondylous precaudal centra 48 to 60, precaudal centra 85 to 100. Colour uniform grey above, light below, no white or dark spots or dark bars, but newborn young with dusky-tipped dorsal and caudal fins. Development viviparous. Size large, adults 82 to 150 cm.

Geographical Distribution: Western Atlantic: Massachusetts to Florida, northern Gulf of Mexico, Venezuela, including Cuba, Jamaica, Barbados, Bermuda, Bahamas; southern Brazil to northern Argentina.



Habitat and Biology: A common to abundant temperate and tropical shark of the continental and insular shelves and upper slopes, ranging from shallow inshore waters and the intertidal to 200 m depth, but occasionally down to 579 m. In US temperate waters it prefers inshore waters less than 18 m deep, with many coming into enclosed bays and harbours, especially with mud or sandy bottoms; in tropical areas it apparently avoids coral reefs. Some smooth-hounds penetrate the lowermost reaches of rivers and are said to occur in fresh water, though it is doubtful that this shark can live in fresh water for extended periods of time like the bull shark, Carcharhinus leucas. Caribbean island populations inhabit deeper water (most below 200 m depth) than continental ones, and prefer rocky bottoms. It is primarily found near or on the bottom, but may occur in midwater off Cuba.

Off southern New England and the middle Atlantic States of the USA this is the second most abundant shark, although falling far short of the spurdog, Squalus acanthias, in numbers. It is said to be the most common local shark in Uruguayian waters.

There is some indication that this shark is divided into several discrete populations, with few or no members of the species occurring in the broad gaps between them (Bigelow & Schroeder, 1948). The best known population is the possibly cold-adapted one which occurs from the Carolinas north along the US Atlantic Coast to New England and southern Canada. The species is uncommon south of North Carolina but is again common off Florida and turns up at many localities in the Gulf of Mexico to southern Mexico, off Bermuda, the Bahamas, and various Caribbean islands and again from southern Brazil to Argentina.

Off the Atlantic coast of the USA the species is migratory, and responds to changes in water temperature by moving. It primarily winters in the area between southern North Carolina and Chesapeake Bay. In the springtime as water warms up on the bottom to at least 6 to 7°C, it moves northward along the coast to New England, and southward to South Carolina. As summer wanes smooth-hounds move offshore and withdraw centrally to their wintering area.

A behavioural experiment involving 10 smooth-hounds apparently of this species (Allee & Dickinson, 1954; Myrberg & Gruber, 1974) indicated that a dominance hierarchy was formed in the experimental population, based on size and not sex, and that individual smooth-hounds, regardless of their position in the hierarchy did not defend territories.

Viviparous, with a yolk-sac placenta; number of young 4 to 20 per litter. The gestation period of smooth-hounds off New England is about 10 months, with mating in midsummer (July) and birth between early May and mid-July of the next year. It has been suggested from growth-curve calculations that the growth rate of this shark is very fast, with maturation after one to two years, but this remains to be confirmed from direct ageing techniques.

Feeds primarily on large crustaceans, especially crabs, but also heavily on American lobsters (Homarus). It also takes small bony fish, including menhaden, stickleback, wrasses, porgies, sculpins and puffers, squid (in springtime in New England waters), gastropods, bivalves, marine annelid worms, and occasional garbage (chicken-heads and other human debris has been found in stomachs of smooth-hounds caught in Cuban waters). Some have been found with quantities of eel-grass (Zostera) in their stomachs, but this may be incidentally taken in while the smooth-hounds are capturing animal prey.

This is a very active shark, constantly patrolling the bottom for food, which can be located when hidden as when in sight, indicating use of other senses including olfactory and electrosense. In captivity they readily attack crabs and shake them vigorously sideways before devouring them, but rarely molest active bony fishes; however, sick, injured or dead fish are quickly devoured. Dusky smooth-hounds are harmless to humans, except for competing with them for crustaceans, especially the valuable American lobster. One estimate quoted in Bigelow & Schroeder (1948) suggested that in Buzzard's Bay, Massachusetts, at the turn of the century, these sharks annually ate 200 000 crabs, 60 000 lobsters, and 70 000 small fish.

Size : Maximum 150 cm, males maturing at about 82 cm, females maturing at about 90 cm and reaching at least 122 cm; size at birth between 34 and 39 cm.

Interest to Fisheries : A locally abundant shark that is primarily fished off Cuba, Venezuela, and Brazil, but no doubt utilized elsewhere in the Caribbean; it is caught with bottom and floating longlines, occasionally with bottom trawls, and utilized fresh and dried salted for human consumption.

Literature : Bigelow & Schroeder (1948); Allee & Dickinson (1954); Heemstra (1973); Myrberg & Gruber (1974).

Remarks : This species is very close to the allopatric Mustelus mustelus and sympatric M. norrisi; the former differs from it in having somewhat shorter labial furrows, a slightly narrower internarial, and less precaudal centra, while the latter is a smaller, slenderer, narrower-headed shark with a narrower internarial, shorter labial furrows, more extensive buccopharyngeal denticles, more diplospondylous precaudal centra, and usually a more falcate ventral caudal lobe in adults (Heemstra, 1973). In addition, there are two new allopatric species of canis-norrisi-like smooth-hounds in the western Atlantic, one of which has often been confused with M. canis, which will be described by P.C. Heemstra.

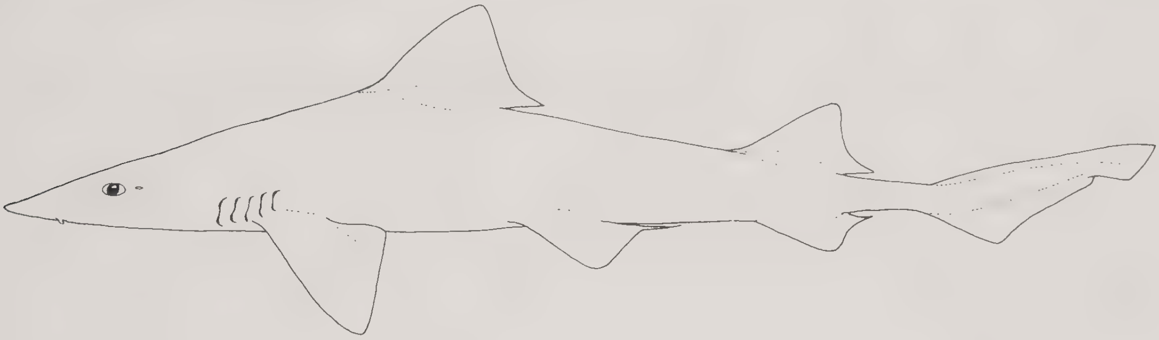
Mustelus dorsalis Gill, 1864

TRIAK Must 5

Mustelus dorsalis Gill, 1864, Proc.Acad.Nat.Sci.Philad., 16:149. Syntypes: U.S. National Museum of Natural History, USNM 8068, 2 specimens 430 to 450 mm; another specimen included under the same catalogue number is M. lunulatus (Heemstra, 1973). Type Locality: "Panama".

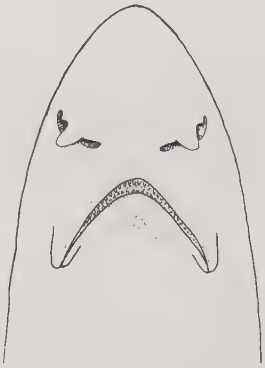
Synonymy : None.

FAO Names : En - Sharptooth smooth-hound; Fr - Emissole blanche; Sp - Musola blanca.



Field Marks : A small, plain Mustelus with high-cusped teeth, a long, acutely pointed snout, very small eyes, broad interorbital, lanceolate lateral trunk denticles, and unfringed dorsal fins.

Diagnostic Features : Body fairly slender. Head moderately long, prepectoral length 19 to 23% of total length; snout long and acutely angular in lateral view, preoral snout 6 to 8.8% of total length, preorbital snout 7.1 to 9.7% of total length; internarial space moderate, 2.1 to 3% of total length; eyes small, eye length 2.6 to 3.5 times in preorbital snout (over 3 times in adults) and 1.8 to 2.9% of total length; interorbital space very broad, 5.1 to 6.2% of total length; mouth long, greater than eye length, 3 to 4% of total length; upper labial furrows slightly longer than lowers or about as long, uppers 1.3 to 2.2% of total length; teeth cuspidate and asymmetric, with cusp prominent and cusplets occasionally present at all sizes; buccopharyngeal denticles present on anterior thirds of mouth floor and palate, and on gill arches. Interdorsal space 16 to 21% of total length; trailing edges of dorsal fins denticulate, without bare ceratotrichia; first dorsal broadly triangular, with posteroventrally sloping posterior margin, its midbase closer to pelvic bases than to pectorals; pectoral fins moderately large, length of anterior margins 12 to 16% of total length, width of posterior margins 8 to 14% of total length; pelvic fins moderately large, anterior margin length 6.7 to 9.1% of total length; anal height 2.7 to 3.4% of total length; anal-caudal space greater than second dorsal space and 4.8 to 6.8% of total length; ventral caudal lobe not falcate and weakly developed in adults. Crowns of lateral trunk denticles lanceolate, with longitudinal ridges extending their entire length. Skeleton not hypercalcified in adults; palatoquadrates not subdivided; monospondylous precaudal centra 38 to 44, diplospondylous precaudal centra 49 to 58, precaudal centra 92 to 99. Colour uniform grey or grey-brown above, light below, no white or dark spots or dark bars. Development viviparous. Size small, adults 43 to 64 cm.



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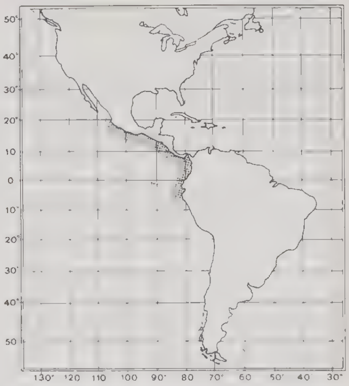
Geographical Distribution : Eastern Pacific: Southern Mexico to Gulf of Guayaquil, Ecuador.

Habitat and Biology : An uncommon, little-known inshore tropical bottom-dwelling shark of the Central and South American continental shelves. Viviparous, with a yolk-sac placenta; number of young 4 per litter. Eats manis shrimps and probably other crustaceans.

Size : Maximum 64 cm, adult males maturing at about 43 cm, adult females at about 43 cm and reaching 64 cm; size at birth 21 to 23 cm.

Interest to Fisheries : Probably caught along with other species of "tollo" (Mustelus) and utilized by fisheries where it occurs, but details are lacking.



Literature : Beebe & Tee-Van (1941); Hildebrand (1946); Kato, Springer & Wagner (1967); Heemstra (1973).

Remarks : This small, distinctive smooth-hound has been confused with other eastern Pacific species. It somewhat resembles the western Atlantic M. higmani, but differs in its higher-cusped teeth, less falcate fins, lanceolate denticles, and more numerous vertebral centra.

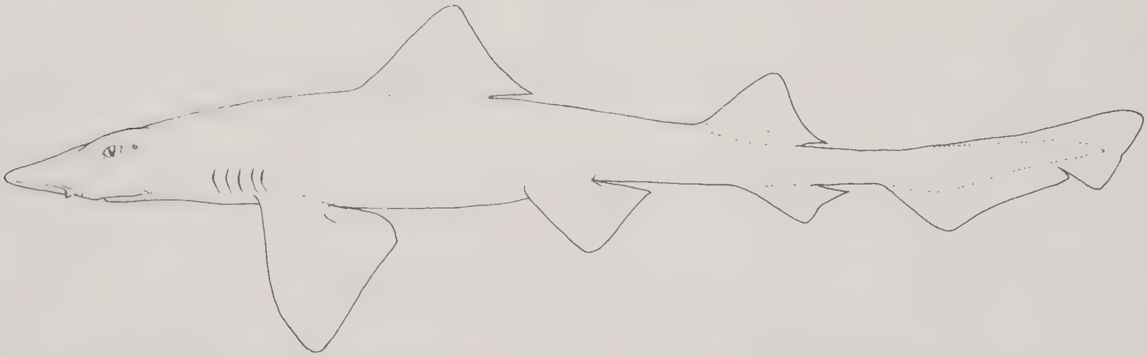
Mustelus fasciatus Garman, 1913

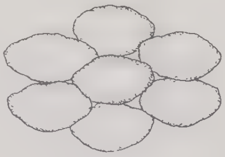
TRIAK Must 9

Galeorhinus fasciatus Garman, 1913, Mem.Mus.Comp.Zool.Harv.Coll., 36:172. Holotype: Museum of Comparative Zoology, Harvard, MCZ 154, 607 mm immature male. Type Locality: Rio Grande do Sul, Brazil.

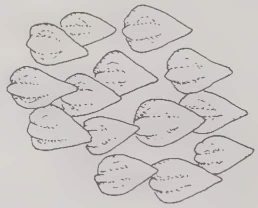
Synonymy : Mustelus striatus Devincenzi, 1920

FAO Names : En - Striped smooth-hound; Fr - Emissole rayée; Sp - Musola listada.





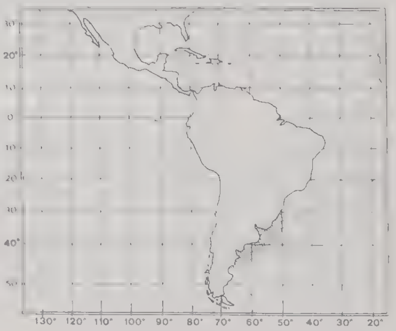
lower teeth



dermal denticles

Field Marks : A fairly stocky Mustelus with a very long head and long, angular, acutely pointed snout, very small eyes, broadly rounded tooth crowns, short caudal peduncle, relatively few precaudal vertebral centra, 58 to 63, and, at least in young and preadolescents, vertical dark bars on the body.

Diagnostic Features : Body fairly stout. Head very long, prepectoral length 22 to 24.5% of total length; snout very long and angular in lateral view, preoral snout 8 to 9% of total length, preorbital snout 9.4 to 10.2% of total length; internarial space broad, 2.9 to 3.4% of total length; eyes small, eye length 3.8 to 4.3 times (largest juveniles at about 62 cm have it over 4) in preorbital snout and 1.9 to 2.5% of total length; interorbital space broad, 4.8 to 5.2% of total length; mouth long, greater than eye length and 3.4 to 4.2% of total length; upper labial furrows considerably longer than lowers, upper furrows 2 to 2.4% of total length; teeth molariform and symmetrical, with cusp and cusplets absent and crown broadly rounded; buccopharyngeal denticles covering most of palate and floor of mouth except medial rear third. Interdorsal space 16 to 19% of total length; trailing edges of dorsal fins denticulate, without bare ceratotrichia; first dorsal broadly triangular, with posteroventrally sloping posterior margin, midbase closer to pelvic bases than pectorals; pectoral fins moderate-sized, length of anterior margins 13 to 15% of total length, width of posterior margins 11 to 13% of total length; pelvic fins large, anterior margin length 7.4 to 9.2% of total length; anal height 2.8 to 3.2% of total length; anal-caudal space shorter than second dorsal height, 4.2 to 5.6% of total length; ventral caudal lobe hardly developed in large juveniles. Crowns of lateral trunk denticles lanceolate, without longitudinal ridges or when present extending up to only half of their length. Skeleton not hypercalcified in large juveniles; palatoquadrates not subdivided; monospondylous precaudal centra 32 to 35, diplospondylous precaudal centra 23 to 30, precaudal centra 58 to 63. Colour grey or grey-brown, above, light below, no white or dark spots but with dark vertical bars on at least young and juveniles. Development unknown. Size large, adults above 62 cm.



Geographical Distribution : Western South Atlantic: Southern Brazil to northern Argentina.

Habitat and Biology : A little-known temperate-water inshore bottom-dwelling shark of the Atlantic South American continental shelf. Live-bearing, but mode of reproduction unknown. Presumably eats crustaceans and other bottom-dwelling invertebrates.

Size : Maximum size probably between 1 and 1.5 m; size at maturity for males above 62 cm; size at birth at or below about 39 cm.

Interest to Fisheries : Fished commercially in Uruguay, and probably elsewhere where it occurs, and utilized fresh-frozen and dried salted for human consumption and for its oil.

Literature : Bigelow & Schroeder (1948); Heemstra (1973).

Remarks : This is a very distinctive species, closest to M. mento but easily separable by its longer and more angular head.

Mustelus griseus Pietschmann, 1908

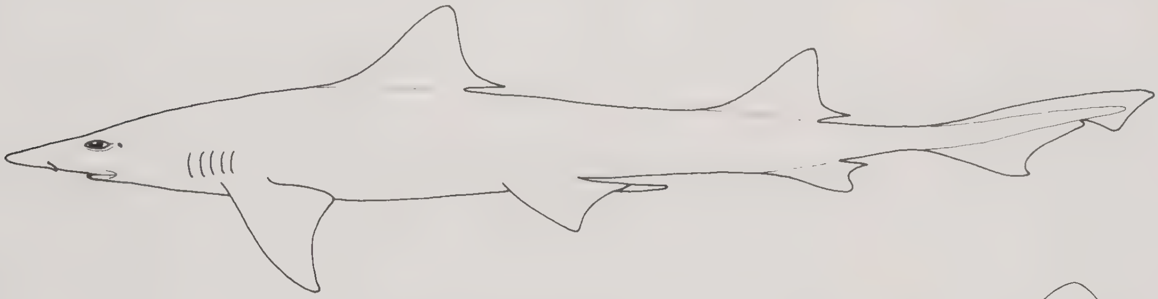
TRIAK Must 10

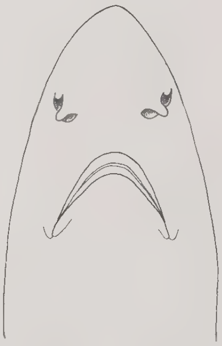
Mustelus griseus Pietschmann, 1908, Sitzungsber.K.Akad.Wiss.Wien, 45:132. Holotype: Specimen of 633 mm formerly in Naturhistorisches Museum, Vienna, apparently lost (Heemstra, 1973). Type Locality: Japan.

Synonymy : Cynias kanekonis Tanaka, 1916.

Other Scientific Names Recently in Use : Mustelus kanekonis (Tanaka, 1916).

FAO Names : En - Spotless smooth-hound; Fr - Emissole côtière; Sp - Musola gris.

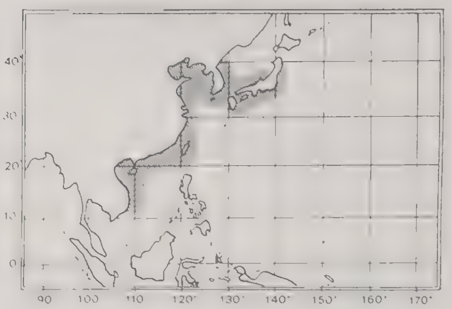




underside of head

Field Marks : An unspotted, moderate-sized Mustelus with a short head and snout, broad internarial space, fairly small eyes, narrow interorbital, upper labial furrows equal to or slightly shorter than lowers, low-crowned teeth with weak cusps, buccopharyngeal denticles covering anterior half of buccal cavity, lateral trunk denticles usually lanceolate and with complete ridges, unfringed dorsal fins, 73 to 80 precaudal centra, and a semifalcate ventral caudal lobe. It is the only smooth-hound with the above characters where it occurs.

Diagnostic Features : Body fairly slender. Head short, prepectoral length 17 to 21% of total length; snout moderately long and bluntly angular in lateral view, preoral snout 5.7 to 7.1% of total length, preorbital snout 6.2 to 7.7% of total length; internarial space broad, 2.4 to 3.2% of total length; eyes fairly small, eye length 2.3 to 3.1 times in preorbital snout and 2.1 to 3.5% of total length; interorbital space narrow, 3.6 to 4.5% of total length; mouth fairly long, somewhat greater than eye length and 2.5 to 3.7% of total length; upper labial furrows equal or slightly shorter than lowers and 0.8 to 1.4% of total length; teeth molariform and asymmetric, with cusp reduced to a low point, cusplets absent except in very young sharks; buccopharyngeal denticles covering anterior half of palate and mouth floor. Interdorsal space 18 to 22% of total length; trailing edges of dorsal fins denticulate, without bare ceratotrichia; first dorsal somewhat falcate, with posterior margin abruptly vertical from apex, its midbase about equidistant between pectoral and pelvic bases; pectoral fins moderate-sized, length of anterior margins 12 to 14% of total length, width of posterior margin 8.3 to 11% of total length; pelvic fins moderately large, anterior margin length 6.8 to 8.4% of total length; anal height 2.7 to 3.4% of total length; anal caudal space greater than second dorsal height, 6.1 to 8.1% of total length; ventral caudal lobe more or less falcate in adults. Crowns of lateral trunk denticles lanceolate or weakly tricuspidate, with longitudinal ridges extending their entire length. Skeleton not hypercalcified in adults, except for slight expansion of scapulocoracoid tips; palatine processes of palatoquadrates subdivided at symphysis, with a short separate medial segment on each side; monospondylous precaudal centra 29 to 35, diplospondylous precaudal centra 40 to 48, precaudal centra 73 to 80. Colour uniform grey or grey-brown, above, light below, no white or dark spots or dark bars. Development viviparous. Size moderate, adults 65 to 101 cm.



Geographical Distribution : Western North Pacific: Japan, the Koreas, China, (including Taiwan Island), Viet Nam.

Habitat and Biology : A common western Pacific temperate and tropical inshore bottom-dwelling shark, found down to at least 51 m depth.

Viviparous, with a yolk-sac placenta; number of young 5 to 16 per litter, with larger adults having larger litters of young. In Japanese waters the gestation period is 10 months, with fertilization occurring in July and birth occurring in April and May.

Probably eats bottom-dwelling invertebrates, especially crustaceans.

Size : Maximum at least 101 cm, adult males maturing between 62 and 71 cm and reaching at least 87 cm, females maturing at about 80 cm and reaching about 101 cm; size at birth about 28 cm.

Interest to Fisheries : Regularly fished off Japan, China and Taiwan Island (Province of China).

Literature : Fowler (1941); Heemstra (1973); Teshima, Mizue & Koga (1974).

Remarks : The name Mustelus kanekonis is often used for this species, but Heemstra (1973) determined that it is a synonym of M. griseus. In its western North Pacific range the only other smooth-hound is M. manazo, an ovoviviparous, white-spotted, smaller species with longer upper labial furrows and other differences.

Mustelus henlei (Gill, 1863)

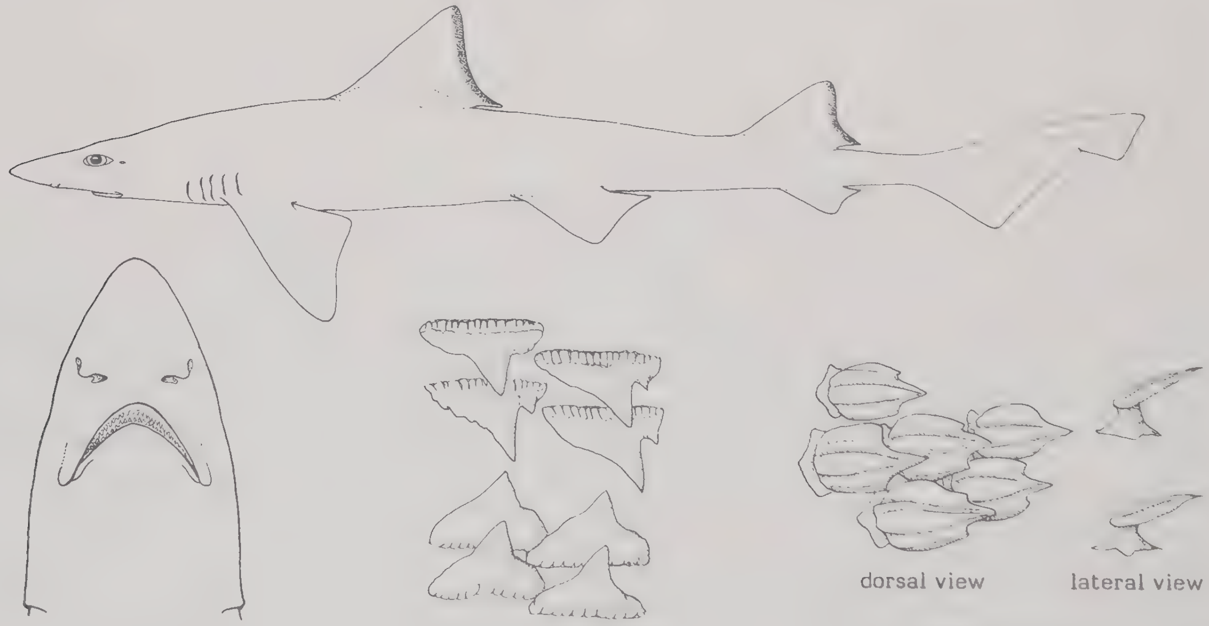
TRIAK Must 11

Rhinotriacis henlei Gill, 1863, Proc.Acad.Nat.Sci.Philad., 1862, 14:486. Holotype: U.S. National Museum of Natural History, USNM 4487, 230 mm. Type Locality: California.

Synonymy : None.

Other Scientific Names Recently in Use : Triakis henlei (Gill, 1863).

FAO Names : En - Brown smooth-hound; Fr - Émissole brune; Sp - Musola parda.



underside of head

upper and lower teeth

dorsal view

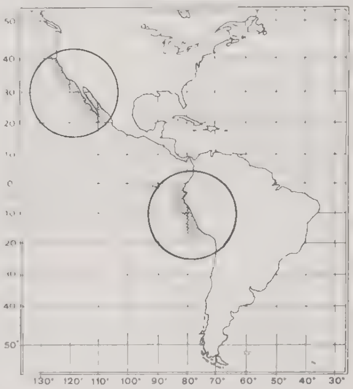
lateral view

dermal denticles

Field Marks : An unspotted, bronzy slender Mustelus with strongly cuspidate teeth, mostly tricuspidate denticles, long caudal peduncle, and broadly frayed posterior dorsal fin margins.

Diagnostic Features : Body fairly slender. Head short, prepectoral length 19 to 22% of total length; snout moderately long and bluntly to sharply angular in lateral view, preoral snout 6.4 to 8% of total length, preorbital snout 6.6 to 8.4% of total length; internarial space broad, 2.6 to 3.4% of total length; eyes large, eye length 1.9 to 2.9 times in preorbital snout and 2.6 to 3.7% of total length; interorbital space fairly narrow, 3.9 to 5.3% of total length; mouth moderately long, subequal to eye length and 2.7 to 3.8% of total length; upper labial furrows longer than lowers, upper furrows 1.6 to 2.4% of total length; teeth cuspidate and asymmetric, with a rather strong primary cusp and usually cusplets present at all ages; buccopharyngeal denticles confined to anterior third of palate and surface of tongue. Interdorsal space 19 to 24% of total length; trailing edges of dorsal fins, and occasionally anal and caudal fins, naked with a broad, conspicuous dark band of bare ceratotrichia; first dorsal broadly triangular, with posteroventrally sloping posterior margin, its midbase closer to pelvic bases than to pectorals; pectoral fins moderately large, length of anterior margins 13 to 16% of total length, width of posterior margin 8.1 to 13% of total length; pelvic fins moderate-sized, anterior margin length 6.2 to 7.9% of total length; anal height 2.7 to 3.8% of total length; anal-caudal space greater than second dorsal height and 6.9 to 8.6% of total length; ventral caudal lobe more or less falcate in adults. Crowns of lateral trunk denticles more or less tricuspidate, with longitudinal ridges extending their entire length. Skeleton not hypercalcified in adults; palatoquadrates not subdivided; monospondylous precaudal centra 39 to 45, diplospondylous precaudal centra 54 to 65, precaudal centra 97 to 106. Colour usually iridescent bronzy-brown above, occasionally greyish, white below; no white spots or dark spots or dark bars. Development viviparous. Size moderate, adults 52 to 90 cm.

Geographical Distribution : Eastern Pacific: Northern California to Gulf of California; Ecuador and Peru.



Habitat and Biology : An abundant inshore to offshore, cold-temperate to warm-temperate or subtropical bottom-dwelling shark of the eastern Pacific continental shelves, found from the intertidal region to at least 200 m depth, and very common in enclosed, shallow, muddy bays. Of the three smooth-hounds found in Californian waters this is the most cold-tolerant, being apparently resident in cold-temperate northern California. In contrast, in normal years without an 'el Niño' or warm-water influx, M. californicus is a regular summer visitor to north-central California (Elkhorn Slough) and resident in warm-temperate southern California, although it was originally described from San Francisco Bay where it is normally absent (unlike M. henlei); ; while the more tropical M. lunulatus may not occur in Californian waters except in the summers of warm-water years. However, all three species were collected by the writer in the Gulf of California during the summer at Guaymas, Sonora, Mexico. In San Francisco Bay this is apparently the most abundant local shark. One tagged individual migrated about 160 km in 3 months. The nature of the local movements of this shark is uncertain, but the writer suspects that in San Francisco Bay during wintertime, it may move out of the bay mouth into the ocean from its usual spring to autumn haunts in the shallows as the salinity drops with rainfall and increased influx of fresh water from the Sacramento-San Joaquin River system.

The microdistribution and population structure of this species may be very localized and spotty: centres of abundance in north-central California are apparently enclosed bays such as Humboldt, Tomales and San Francisco Bays, while it is uncommon in Monterey Bay and Elkhorn Slough.

Healthy individuals kept in captivity in a large circular tank at the US National Marine Fisheries Service Tiburon Laboratory proved to be active bottom-dwelling swimmers, resting on the substrate but often actively patrolling with their undersurfaces only a few millimetres above the substrate, although sometimes swimming in midwater or at the surface. The broad pectoral and pelvic fins and relatively flat undersurface of this and other smooth-hounds may allow them to ride on a ground effect close to the substrate, making for more efficient quartering of the bottom in search of prey. Brown smooth-hounds were found to be amazingly agile as they swam close to the bottom; they were observed to swim with considerable speed straight up to the vertical wall of the tank, but instead of hitting, they made high-speed 90 degree transitions and continued to swim vertically upward with their undersides close to the tank wall, and would often turn and swim horizontally with their body axis rotated 90 degrees and their ventral surfaces still riding just off the tank wall. This species is readily kept in large aquaria if not badly traumatized during capture.

Viviparous with a yolk-sac placenta; 3 to 5 young per litter.

Eats crabs and shrimp, ghost shrimps, manis shrimp, isopods, squid, polychaete worms, tunicates, and small bony fishes, including anchovies, surf perch, gobies and flatfish, as well as topsmelt eggs. Crustaceans, especially crabs, shrimp and isopods are the most important prey of these sharks, followed by polychaete worms and fish. Small grapsid crabs are more frequent prey items to smaller sharks below 60 cm while cancrid crabs, ghost shrimp, fish and squid are more readily taken by larger sharks 80 cm and above. The presence of shore (grapsid) crabs (Hemigrapsus oregonensis) in the diet suggests that this shark readily feeds in the intertidal, and is agile enough to readily capture these small, active crabs. When attacking large cancrid crabs in captivity the brown smooth-hound was observed to rush in and grab the defending crab by a cheliped, shaking it vigorously and usually causing its appendage to autotomize.

This shark is broadly sympatric in its northern range with another houndshark, the leopard shark, *Triakis semifasciata*, which occurs in similar microhabitats. The leopard shark differs noticeably in its diet, eating possibly less shrimp, more and larger fish, more fish eggs and considerable numbers of innkeeper worms (*Urechis*) and clam siphons.

Size: Maximum about 95 cm, males maturing between 52 and 66 cm and reaching over 67 cm, females maturing between 51 and 63 cm and reaching over 89 cm; size at birth between 19 and 21 cm.

Interest to Fisheries: An abundant inshore shark, fished commercially in the Gulf of California and utilized fresh or fresh-frozen for human consumption; commonly taken by sports anglers in California.

Literature: Roedel & Ripley (1950); Herald & Ripley (1951); Kato, Springer & Wagner (1967); Heemstra (1973); Russo (1975); de Wit (1975); Talent (1982); L.J.V. Compagno, unpub.observ. D. Ebert (pers. comm.).

Remarks: For details of the taxonomic history of the brown smooth-hound see Compagno (1970, 1979) and Heemstra (1973), who also recorded it for the first time from the Southern Hemisphere (Ecuador and Peru). Heemstra also noted that Bigelow & Schroeder (1948) described a specimen in the Harvard collection as *M. schmitti*, labelled as coming from Rio Grande do Sul, Brazil, which is actually *M. henlei*. With no other evidence on the occurrence of *henlei* in the Atlantic, Heemstra was inclined to regard the record as questionable (and possibly a result of mislabelling), which the writer concurs on.

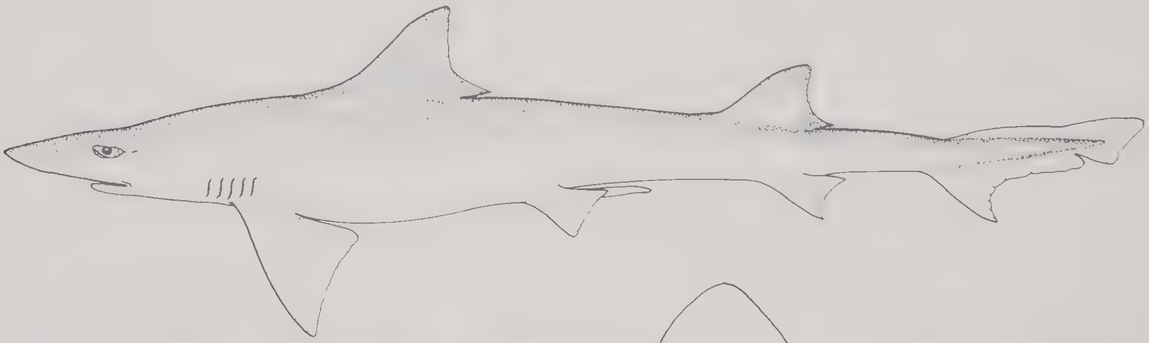
Mustelus higmani Springer & Lowe, 1963

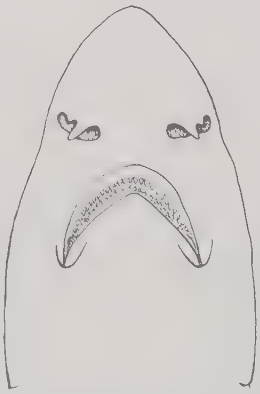
TRIAK Must 12

Mustelus higmani Springer & Lowe, 1963, *Copeia*, 1963, (2):245, fig. 1. Holotype: U.S. National Museum of Natural History, USNM 156930, 480 mm adult male. Type Locality: Northeast of Parimaribo, Surinam, 22 m depth.

Synonymy: None.

FAO Names: En - Smalleye smooth-hound; Fr - Emissole tiyeux; Sp - Musola amarilla.





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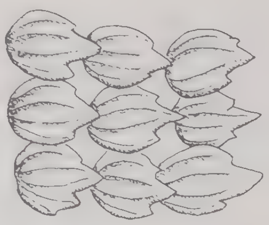
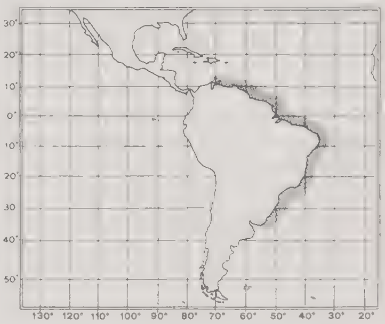


dermal denticles

Field Marks: A small, plain *Mustelus* with fairly low-cusped teeth, a long, acutely pointed snout, very small eyes, broad interorbital space, mostly tricuspidate lateral trunk denticles, and unfringed dorsal fins.

Diagnostic Features: Body fairly slender. Head moderately long, prepectoral length 19 to 24% of total length; snout long and sharply angular in lateral view, preoral snout 6.9 to 10.3% of total length, preorbital snout 6.9 to 9.9% of total length; internarial space broad, 2.7 to 3.8% of total length; eyes small, eye length 2.8 to 3.4 times in preorbital snout and 2.2 to 3.4% of total length; interorbital space very broad, 4.5 to 6.3% of total length; mouth moderately long, slightly longer than eye length, 2.3 to 3.6% of total length; upper labial furrows about as long as lowers, upper furrows 0.8 to 1.8% of total length; teeth molariform and asymmetric, with cusp low and blunt or pointed; buccopharyngeal denticles covering anterior half of palate and mouth floor. Interdorsal space 17 to 23% of total length; trailing edges of dorsal fins denticulate, without bare ceratotrichia; first dorsal fairly falcate, its posterior margin nearly vertical from apex, its midbase about equidistant between pectoral and pelvic bases or slightly closer to pectorals; pectoral fins fairly small, length of anterior margins 11 to 14% of total length, width of posterior margin 6.7 to 10% of total length; pelvic fins moderately large, anterior margin length 6.7 to 10% of total length; anal height 2.9 to 4.6% of total length; anal-caudal space greater than second dorsal height, 6 to 9.2% of total length; ventral caudal lobe more or less falcate in adults. Crowns of lateral trunk denticles mostly strongly tricuspidate, with longitudinal ridges extending their entire length. Skeleton not hypercalcified in adults; palatoquadrates not subdivided; monospondylous precaudal centra 34 to 39, diplospondylous precaudal centra 43 to 50, precaudal centra 80 to 90. Colour uniform grey or grey-brown, above, light below, no white or dark spots or dark bars. Development viviparous. Size small, adults 43 to 64 cm.



Geographical Distribution : Western Atlantic: Venezuela to southern Brazil.

Habitat and Biology : An abundant but localized tropical bottom-dwelling shark of the South American Atlantic continental shelf, occurring close inshore to well offshore, to 101 m depth, on mud, sand and shell bottoms. Occurs in shallow brackish water at the Orinoco River mouth, but not known to penetrate fresh water. There is at least partial sexual segregation, as catches have been made of considerable numbers of adults all of one sex.

Viviparous, with a yolk-sac placenta, number of young 1 to 7 per litter, most commonly 3 to 5, with sex ratio approximately equal for over 200 embryos sexed. In collections of embryos reported by Springer & Lowe (1963) both small and large embryos occurred during the months of June to September each month, with only a few large embryos taken in November; no seasonality is apparent from available data.

Feeds primarily on crustacea, with occasional individuals taking bony fish, squid, and coelenterates. Manis shrimp were the commonest crustaceans reported by Springer & Lowe (1963), followed by brachyuran crabs, hermit crabs, and shrimp.

Size : Maximum 64 cm, males maturing at about 43 cm and reaching at least 49 cm, females maturing at about 48 cm and reaching over 58 cm; size at birth between 21 and 24 cm.

Interest to Fisheries : Probably regularly fished in its range, being very common in some areas; caught mainly with bottom longlines, beam trawls and shrimp seines, and utilized fresh and dried salted for human consumption.

Literature : Springer & Lowe (1963); Cervigon (1966); Heemstra (1973).

Remarks : The biology of this species is discussed in Springer & Lowe (1963). This small, broad-headed species is one of the smallest of its genus; it resembles the eastern Pacific M. dorsalis, but differs in its generally lower-cusped teeth, more falcate fins, tricuspidate denticles, and less numerous vertebral centra.

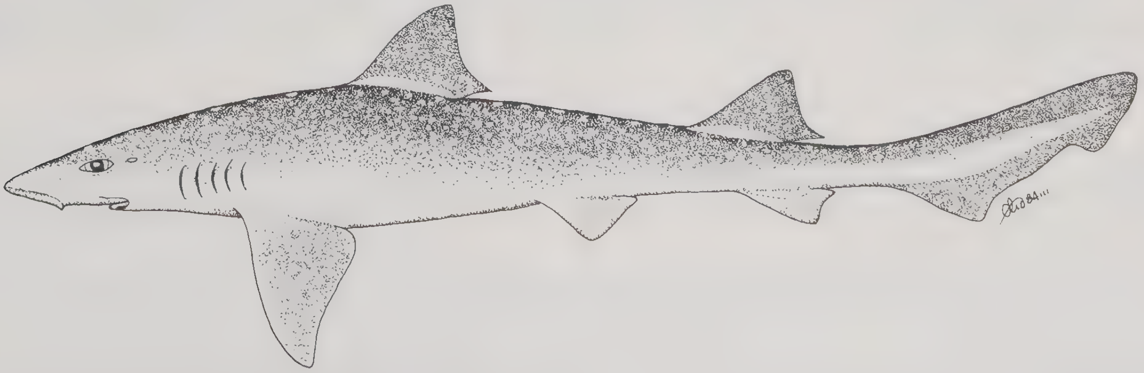
Mustelus lenticulatus Phillipps, 1932

TRIAK Must 13

Mustelus lenticulatus Phillipps, 1932, New Zealand J.Sci.Tech., 13(4):226. Holotype: National Museum of New Zealand (Dominion Museum). Type locality: Wellington Harbor, Wellington, New Zealand.

Synonymy : None.

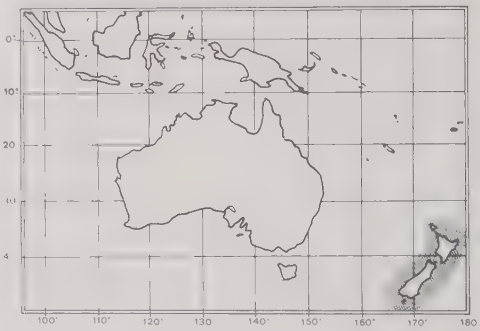
FAO Names : En - Spotted estuary smooth-hound; Fr - Emissole grivelée; Sp - Musola manchada.



Field Marks : A white-spotted Mustelus with a broad internarial space, long upper labial furrows, dorsal fin margins not frayed, relatively large pectoral and pelvic fins, buccophryngeal denticles confined to anterior end of mouth, and 87 to 95 precaudal centra. It is the only species of Mustelus in New Zealand waters.

Diagnostic Features: Body fairly slender. Head short, prepectoral length 17 to 21% of total length; snout moderately long and bluntly angular in lateral view, preoral snout 5.9 to 7.3% of total length, preorbital snout 6.6 to 8.2% of total length; internarial space moderate, 2.4 to 2.9% of total length; eyes fairly large, eye length 1.8 to 3.2 times in preorbital snout and 2.4 to 4.4% of total length; interorbital space fairly broad, 4.1 to 5.2% of total length; mouth short, subequal to eye length and 2.6 to 3.5% of total length; upper labial furrows considerably longer than lowers, upper furrows 1.9 to 2.9% of total length; teeth molariform and asymmetric, with cusp reduced to a low point; condition of buccopharyngeal denticles unknown. Interdorsal space 18 to 24% of total length; trailing edges of dorsal fins denticulate, without bare ceratotrichia; first dorsal broadly triangular, with posteroventrally sloping posterior margin, its midbase closer to pelvic bases than to pectorals; pectoral fins fairly large and broad, length of anterior margins 12 to 16% of total length, width of posterior margin 8.7 to 17% of total length; pelvic fins moderately large, anterior margin length 7.2 to 8.7% of total length; anal height 2.7 to 4.3% of total length; anal-caudal space somewhat greater than second dorsal height, 6.5 to 8.7% of total length; ventral caudal lobe not strongly falcate in adults. Crowns of lateral trunk denticles lanceolate, with longitudinal ridges possibly extending their entire length. Skeleton not hypercalcified in adults; palatoquadrates not subdivided; monospondylous precaudal centra 35 to 41, diplospondylous precaudal centra 50 to 56, precaudal centra 87 to 95. Colour grey or grey-brown, above, light below, usually with numerous white spots but lacking dark spots or dark bars. Development ovoviviparous. Size large, adults 78 to 137 cm.

Geographical Distribution: Western South Pacific: New Zealand.



Habitat and Biology: A common, temperate bottom-dwelling shark of the New Zealand insular shelves, often found close inshore but ranging to 220 m depth. It has seasonal inshore-offshore movements, retreating into deeper water in winter, as well as shorewise movements. A schooling species, with separation by size and sex: immatures form schools separate from the largely unisexual schools of adults. On the fishing grounds sex ratios of adults change as the fishing season, from September to April, progresses.

Ovoviviparous, without a placenta, number of young 2 to 23 per litter, with larger females having larger numbers of young. The sex ratio of embryos is virtually 1:1. The gestation period is about 11 months, and the period of ovulation may exceed six months. Birth is thought to occur offshore, in summer, after which time females come inshore to mate, and travel to summer feeding grounds where adults and juveniles feed heavily on bottom crustaceans. In autumn, these sharks begin to migrate back into deeper water. This may be a fast-growing species, maturing between two to four years after birth (Francis, 1981), but this needs to be confirmed by direct ageing methods such as calibrating vertebral rings.

Eats crustaceans, especially crabs.

Size: Maximum about 137 cm; males maturing at about 78 to 89 cm and reaching about 115 cm; females maturing at about 79 to 113 cm and reaching 137 cm; size at birth about 30 to 32 cm.

Interest to Fisheries: A shark of considerable commercial importance, comprising nearly 5% by weight of New Zealand fish landings in 1978. Commercial fisheries currently catch most of their "rig" (a South Island name for this shark) with gillnets and trawls. Utilized fresh for human consumption. Commonly taken by sports anglers with rod and reel.

Literature: Fowler (1948); Heemstra (1973); Francis & Mace (1980); Francis (1981).

Remarks: Heemstra (1973) determined that all New Zealand smooth-hounds belong to one ovoviviparous species. This is particularly close to the Australian *M. antarcticus*, but differs in having more precaudal vertebrae and slightly larger pelvic fins.

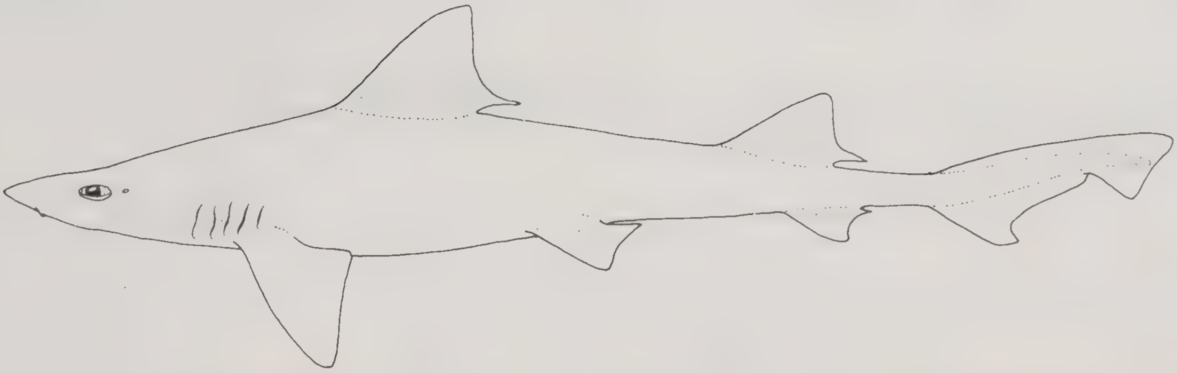
Mustelus lunulatus Jordan & Gilbert, 1883

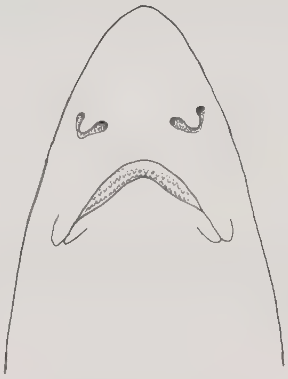
TRIAK Must 14

Mustelus lunulatus Jordan & Gilbert, 1883, *Proc.U.S.Nat.Mus.*, 5:108. Syntype: U.S. National Museum of Natural History, USNM 29211, 620 mm. Type Locality: Mazatlan, Mexico.

Synonymy: None.

FAO Names: En - Sicklefin smooth-hound; Fr - Emissole mamon; Sp - Musola segadora.





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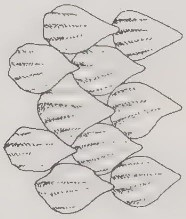
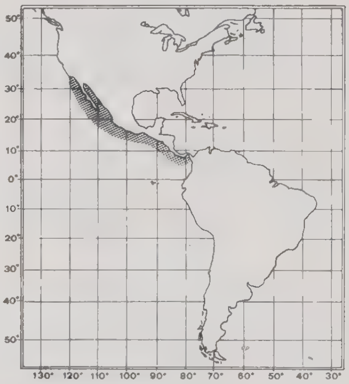


dermal denticles

Field Marks : An unspotted Mustelus with a short head, broad internarial space, relatively small eyes, narrow head, long mouth, upper labial furrows shorter than lowers, strongly falcate fins and 74 to 82 precaudal vertebral centra.

Diagnostic Features : Body fairly slender. Head short, prepectoral length 19 to 21% of total length; snout moderately long and bluntly angular in lateral view, preoral snout 5.6 to 6.7% of total length, preorbital snout 6.3 to 8.1% of total length; internarial space broad, 2.3 to 3.3% of total length; eyes fairly large, eye length 2.9 to 3.7 times in preorbital snout and 2.2 to 3% of total length; interorbital space fairly broad, 4.3 to 4.9% of total length; mouth very long, greater than eye length and 3.4 to 3.9% of total length; upper labial furrows shorter than lowers, upper furrows 0.8 to 1.2% of total length; teeth molariform and asymmetric, with cusp reduced to a low point, cusplets absent except in very young sharks; condition of buccopharyngeal denticles unknown. Interdorsal space 18 to 22% of total length; trailing edges of dorsal fins denticulate, without bare ceratotrichia; first dorsal falcate with posterior margin vertical from apex, midbase closer to pectoral bases than to pelvics; pectoral fins fairly small, length of anterior margins 13 to 16% of total length, width of posterior margin 10 to 13% of total length; pelvic fins moderate-sized, anterior margin length 7.4 to 9.1% of total length; anal height 3.1 to 3.9% of total length; anal-caudal space greater than second dorsal height, 5.9 to 7.4% of total length; ventral caudal lobe strongly falcate in adults. Crowns of lateral trunk denticles lanceolate, with longitudinal ridges extending about 2/3 of crown length. Skeleton not hypercalcified in adults; palatoquadrates not subdivided; monospondylous precaudal centra 28 to 34, diplospondylous precaudal centra 43 to 51, precaudal centra 74 to 82. Colour uniform grey or grey-brown, above, light below, without white or dark spots or dark bars. Development uncertain. Size large, adults 70 to 110+cm.



Geographical Distribution : Eastern North Pacific: Southern California to Panama.

Habitat and Biology : An abundant but little-known warm-temperate to tropical bottom-dwelling shark of the eastern Pacific continental shelves, close inshore to well offshore. Mode of reproduction uncertain; presumably viviparous.

Size : Maximum possibly 170 cm, males mature between 70 and 83 cm, and reaching 110+cm; adult female 97 cm; size at birth between 32 and 35 cm.

Interest to Fisheries : An abundant inshore species in warm-temperate to tropical waters in the eastern Pacific, commonly taken by longline in the Gulf of California, and utilized for human consumption.

Literature : Beebe & Tee-Van (1941); Kato, Springer & Wagner (1967); Heemstra (1973).

Remarks : Kato, Springer & Wagner (1967) called attention to the existence of "at least two unidentified smooth-hounds with fins similar to those of the sicklefin smooth-hound" in the eastern Pacific. Heemstra (1973) studied the matter further and indicated that these are undescribed tropical species ranging from the Gulf of California south to Ecuador and the Galapagos Islands, and plans to describe them in a revision of his 1973 Ph.D. thesis (P.C. Heemstra, pers. comm.).

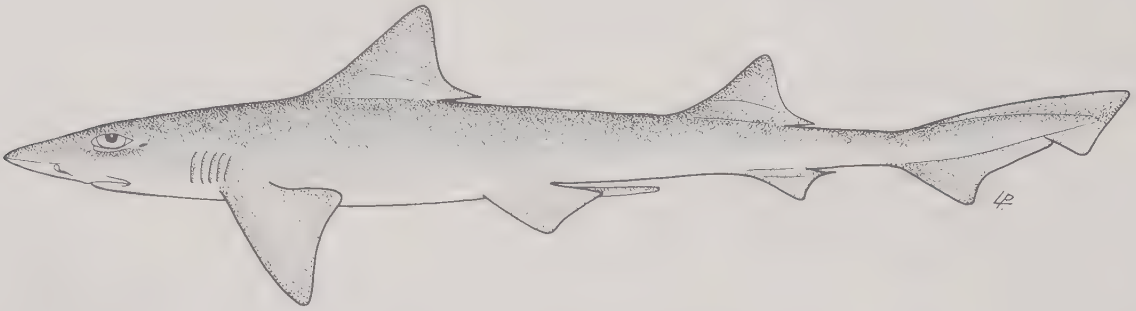
Mustelus manazo Bleeker, 1854

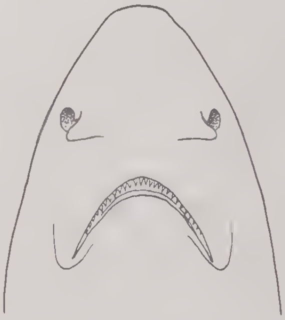
TRIAK Must 6

Mustelus manazo Bleeker, 1854, Nat.Tijdschr.Nederland.-Indeë, 6:422. Syntypes: Rijksmuseum van Natuurlijke Historie, RMNH 7396, 350 to 460 mm. Type Locality: Nagasaki Market, Japan.

Synonymy : None.

FAO Names : En - Starspotted smooth-hound; Fr - Emissole etoilée; Sp - Musola celestial.





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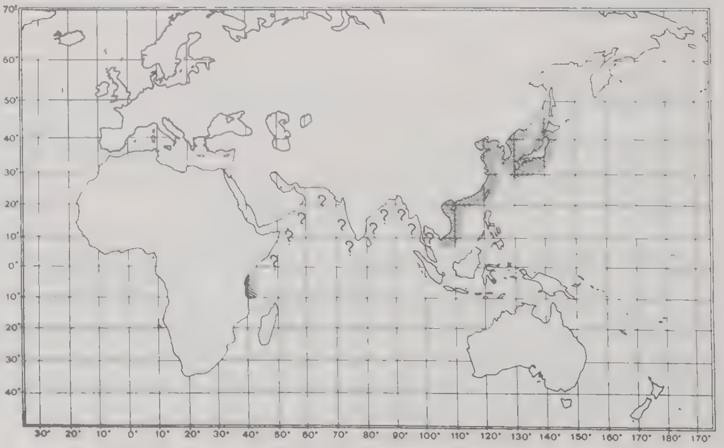
Field Marks : A moderate-sized, white-spotted Mustelus with relatively narrow internarial space, buccopharyngeal denticles covering almost entire oral cavity, unfringed dorsal fins, relatively small pectoral and pelvic fins, and 71 to 91 precaudal centra. It is the only white-spotted smooth-hound in the Indian Ocean and western North Pacific.

Diagnostic Features : Body fairly slender. Head short, prepectoral length 17 to 21% of total length; snout moderately long and bluntly angular in lateral view, preoral snout 5.7 to 7.5% of total length, preorbital snout 6 to 7.8% of total length; internarial space fairly narrow, 2 to 2.9% of total length; eyes large, eye length 1.7 to 2.5 times in preorbital snout and 2.4 to 4.1% of total length; interorbital space narrow, 3.7 to 4.5% of total length; mouth fairly short, about equal to eye length and 2.5 to 3.7% of total length; upper labial furrows considerably longer than lowers and 1.9 to 2.5% of total length; teeth molariform and asymmetric, with cusp reduced to a low point; buccopharyngeal denticles covering almost entire palate and floor of mouth. Interdorsal space 19 to 23% of total length; trailing edges of dorsal fins denticulate, without bare ceratotrichia; first dorsal broadly triangular, with posteroventrally sloping posterior margin, its midbase closer to pelvic bases than to pectorals; pectoral fins moderate-sized, length of anterior margins 11 to 15% of total length, width of posterior margins 7.5 to 14% of total length; pelvic fins moderate-sized, anterior margin length 5.4 to 8.2% of total length; anal height 2.2 to 3.4% of total length; anal caudal space greater than second dorsal height, and 6.5 to 9% of total length; ventral caudal lobe not falcate in adults. Crowns of lateral trunk denticles lanceolate, with longitudinal ridges extending their entire length. Skeleton not hypercalcified in adults; palatoquadrates not subdivided; monospondylous precaudal centra 33 to 41, diplospondylous precaudal centra 35 to 54, precaudal centra 71 to 91. Colour uniform grey or grey-brown, above, light below, usually with numerous white spots but no dark spots or dark bars. Development ovoviviparous. Size moderate, adults 55 to 117 cm.

Geographical Distribution : Western North Pacific: Southern Siberia, Japan, the Koreas, China, including Taiwan Island, Viet Nam. Western Indian Ocean: Kenya (P.C. Heemstra, pers. comm.).

Habitat and Biology : An abundant, wide-ranging temperate and tropical bottom-dwelling shark of continental waters, in the intertidal and subtidal regions, commonly close inshore, especially on mud and sand bottoms.

Ovoviviparous, without a yolk-sac placenta; number of young 1 to 22, mostly 2 to 6, average about 5, increasing markedly with size of mother. Gestation period about 10 months, with young born in spring. Adults mate in summer (June and July). Apparently fairly



fastgrowing (based on growth curves, length-frequency data and growth rings and size increase of vertebrae) with maturity occurring between three and four years after birth (Taniuchi, Kuroda & Nose, 1983).

Eats mostly bottom invertebrates, with crustacea in about 85% of 412 individuals examined by Taniuchi, Kuroda & Nose (1983), fish 23%, polichaetes 18%, and sipunculoid worms 13%. Crustacean prey primarily brachuran crabs, including cancrids and portunids, but also anomuran crabs, ghost shrimp, true shrimp, and manis shrimp; fish include jacks, herring, filefish, morids and mackeral; eggs (of fish?) and bivalve molluscs are also eaten.

Size : Maximum about 117 cm; males maturing at about 62 to 70 cm and reaching about 96 cm, females maturing between 62 and 70 cm, and reaching 117 cm; size at birth about 30 cm.

Interest to Fisheries : An important species off Japan, fished with longlines and probably other gear; meat utilized for human consumption. Also fished off China, including Taiwan Island and the Koreas, and probably elsewhere where it occurs.

Literature : Fowler (1941); Okada (1955); Lindberg & Legeza (1959); Teshima, Yoshimura & Mizue (1971); Heemstra (1973); Teshima, Mizue & Koga (1974); Masuda, Araga & Yoshino (1975); Francis (1981); Taniuchi, Kuroda & Nose (1983).

Remarks : Until recently Red Sea, Indian Ocean and western North Pacific smooth-hounds were mostly referred to this species (cf. Fowler, 1941), but Dr P.C. Heemstra (1973 and pers. comm.) found that most valid records of the species were from the western North Pacific, from Japan, the Koreas and the Soviet Union to Viet-Nam; an exception is material collected off Kenya, to be reported by Dr Heemstra. Red Sea and Indo-Pakistani-Sri-Lankan Mustelus are referable to M. mosis

Mustelus manazo is very close to other white-spotted Eastern Hemisphere smooth-hounds (all of which are allopatric to M. manazo), but differs from them in its smaller size. It additionally differs from M. asterias in having fewer vertebrae, from M. palumbes in having smaller fins, and from M. antarcticus and M. lenticulatus in having a narrower internarial, more extensive buccopharyngeal denticles, and less falcate caudal fin.

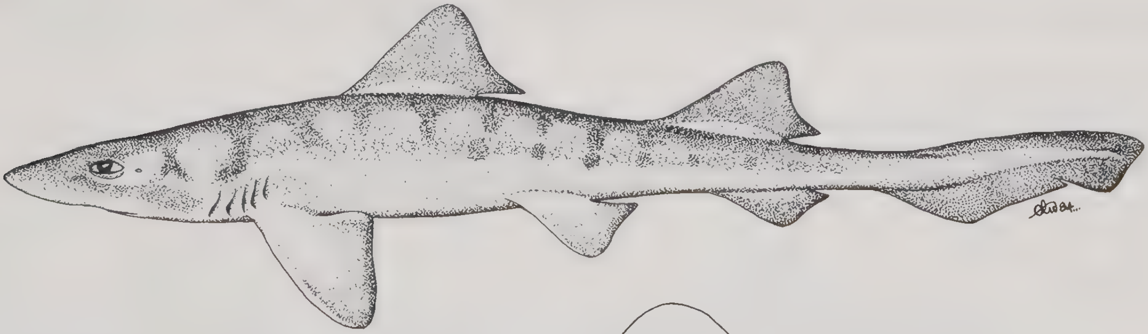
Mustelus mento Cope, 1877

TRIAK Must 15

Mustelus mento Cope, 1877, Proc.American Philos.Soc., 17:47. Holotype: Academy of Natural Sciences of Philadelphia, ANSP 21104, 300 mm. Type Locality: Peru.

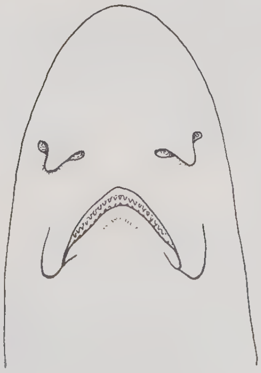
Synonymy : Mustelus edulis Perez Canto, in Philippi, 1887; Mustelus abbotti Evermann & Radcliffe, 1917.

FAO Names : En - Speckled smooth-hound; Fr - Emissole fine; Sp - Musola fina.



Field Marks : A white-spotted thickset Mustelus with a bluntly angular, short snout, short caudal peduncle, and broadly rounded, acuspidate teeth.

Diagnostic Features : Body stocky. Head fairly short, prepectoral length 18 to 23% of total length; snout moderately long and bluntly angular in lateral view, preoral snout 6 to 7.9% of total length, preorbital snout 6.9 to 9% of total length; internarial space broad, 2.4 to 3% of total length; eyes fairly small, eye length 2.2 to 3.9 times in preorbital snout and 1.7 to 3.5% of total



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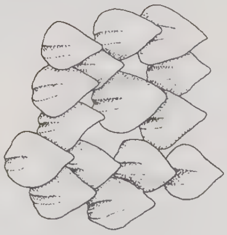
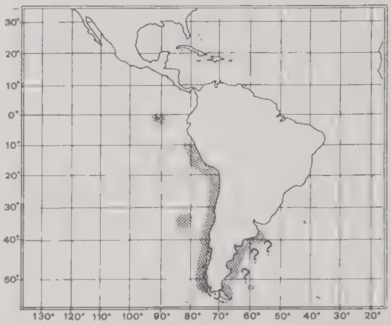


dermal denticles

length; interorbital space moderately broad, 4.5 to 5.6% of total length; mouth short, subequal to eye length and 2.5 to 3.5% of total length; upper labial furrows usually slightly longer than lowers and 2.2 to 2.9% of total length; teeth molariform and symmetrical, with cusp absent and crown broadly rounded; buccopharyngeal denticles covering almost all of palate and mouth floor. Interdorsal space 17 to 22% of total length; trailing edges of dorsal fins denticulate, without bare ceratotrichia; pectoral fins fairly large, anterior margin length 12 to 17% of total length, width of posterior margins 8.5 to 14% of total length; pelvic fins fairly large, anterior margin length 7.6 to 9.7% of total length; anal height 2.8 to 3.9% of total length; anal caudal space somewhat less than second dorsal height, and 5.7 to 7.5% of total length; ventral caudal lobe more or less falcate in adults. Crowns of lateral trunk denticles lanceolate, with longitudinal ridges, when present, extending only on their anterior halves. Skeleton not hypercalcified in adults; palatine processes of palatoquadrates subdivided at symphysis with a short separate medial segment on each side; monospondylous precaudal centra 30 to 41, diplospondylous precaudal centra 28 to 52, precaudal centra 71 to 91. Colour uniform grey or grey-brown above, light below, with numerous white spots but no dark spots; dark bars present in young below 35 cm. Development ovoviviparous. Size large, adults 65 to 130 cm.



Geographical Distribution : Eastern South Pacific: Galapagos Islands, Peru, Chile, Juan Fernandez Island. Western South Atlantic: Argentina.

Habitat and Biology : A temperate bottom-dwelling shark of continental and insular shelves, found inshore and offshore, at depths of 16 to 50 m. Ovoviviparous, number of young 7 per litter.

Size : Maximum recorded 130 cm, males maturing between 65 and 76 cm, females maturing between 86 and 90 cm; size at birth about 30 cm.

Interest to Fisheries : Regularly taken in its area along with other species of "tollo" (Mustelus), for human consumption (N. Chirichigno, pers. comm.).

Literature : Bigelow & Schroeder (1948); Hildebrand (1949); Kato, Springer & Wagner (1967); Heemstra (1973).

Remarks : Bigelow & Schroeder (1948) summarized nominal South Atlantic, Argentinian records for this species, which may possibly be based on other species, perhaps M. schmitti or M. fasciatus. The rounded teeth of this species are shared by M. fasciatus, but other species of Mustelus have weakly to strongly cuspidate teeth.

Mustelus mosis Hemprich & Ehrenberg, 1899

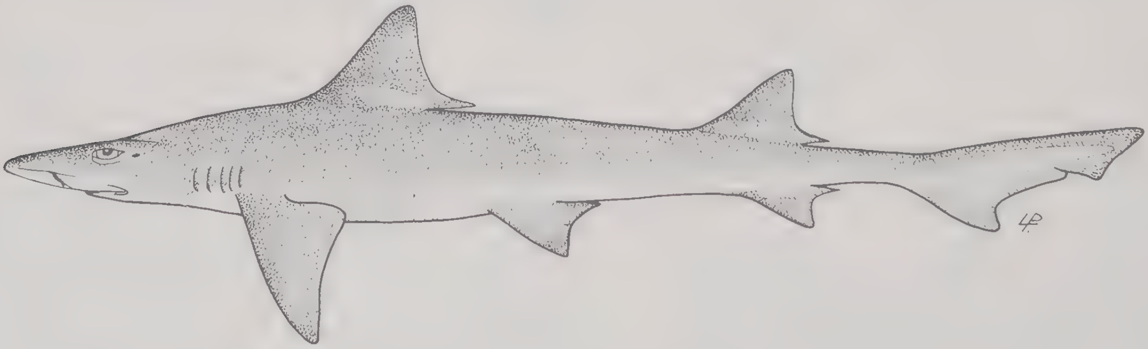
TRIAK Must 7

Mustelus mosis Hemprich & Ehrenberg, 1899, Symbol.Physic.Icones Ined., Zool., pl. 7, fig. 3. Holotype: Zoologisches Museum, Humboldt Universität, Berlin, ZMB 4501, stuffed specimen. Type Locality: Red Sea.

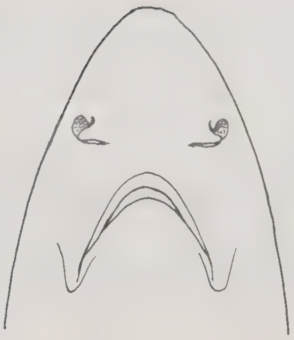
Synonymy : None.

Other Scientific Names Recently in Use : Mustelus manazo (not Bleeker, 1854)

FAO Names : En - Arabian smooth-hound; Fr - Emissole d'Arabie; Sp - Musola arábiga.



Field Marks : A unspotted, large Mustelus with a short head and snout, broad internarial space, large eyes, narrow interorbital space, upper labial furrows about equal to lowers, low-crowned teeth with weak cusps, buccopharyngeal denticles covering anterior half or entire buccal cavity, lateral trunk denticles usually lanceolate and with complete ridges, unfringed dorsal fins, a semifalcate ventral caudal lobe, 59 to 81 precaudal centra, and heavily hypercalcified head and other cartilages. This is the only species of Mustelus in most areas where it occurs.



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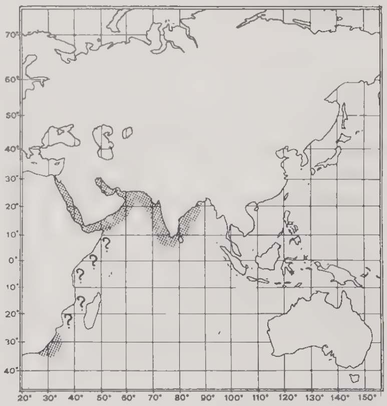
Diagnostic Features: Body fairly slender. Head short, prepectoral length 17 to 22% of total length; snout moderately long and bluntly angular in lateral view, tip rather expanded and bulbous in adults with hypercalcified rostral mass, preoral snout 5.5 to 6.6% of total length, preorbital snout 6.3 to 7.3% of total length; internarial space broad, 2.4 to 2.9% of total length; eyes fairly large, eye length 2.1 to 3 times in preorbital snout and 2.5 to 3.3% of total length; interorbital space 2.4 to 2.9% of total length; mouth moderately long, greater than eye length, its length 2.7 to 3.8% of total length; upper labial furrows about equal to lowers and 1.3 to 2% of total length; teeth molariform and asymmetric, with cusp reduced to a low point, cusplets absent except in very young sharks; buccopharyngeal denticles covering anterior half of palate and mouth floor or entire palate and floor. Interdorsal space 20 to 23% of total length; trailing edges of dorsal fins denticulate, without bare ceratotrichia; first dorsal somewhat falcate, with posterior margin nearly vertical from apex, its midbase closer to pectoral bases than to pelvics; pectoral fins moderate-sized, length of anterior margin 13 to 15% of total length, width of posterior margin 9.8 to 13% of total length; pelvic fins small, anterior margin length 6.5 to 7.9% of total length; anal height 2.9 to 4.7% of total length; anal caudal space greater or subequal to second dorsal height, and 7.1 to 9.1% of total length; ventral caudal lobe more or less falcate in adults. Crowns of lateral trunk denticles lanceolate or tricuspidate, with longitudinal ridges extending their entire length. Rostral node of cranium, hyomandibulae, scapulocoracoid tips, sometimes supraorbital crests and rostral shafts of cranium, extrabranchial cartilages, and radials of second dorsal, pectoral, pelvic, and caudal fin radials hypercalcified in adults; palatoquadrates not subdivided; monospondylous precaudal centra 25 to 39, diplospondylous precaudal centra 34 to 48, precaudal centra 59 to 81. Colour uniform grey or grey-brown, above, light below, no white or dark spots or dark bars; South African examples generally have white-tipped first dorsal and black-tipped second dorsal and caudal. Development viviparous. Size large, adults 63 to 150 cm.

Geographical Distribution: Western Indian Ocean: Red Sea and the "Gulf" to India, Pakistan and Sri Lanka; Natal, South Africa (P.C. Heemstra, pers. comm.).



Habitat and Biology: A common bottom-dwelling shark of continental waters, found inshore and offshore, some on coral reefs. Viviparous, number of young 6 to 10 per litter. Eats small bottom fish, molluscs, and crustaceans. Readily lives in captivity.

Size: Maximum 150 cm, males maturing between 63 and 67 cm and reaching 106 cm, adult female 82 cm.

Interest to Fisheries: Apparently regularly fished off Pakistan and India and used for human food.

Literature: Gohar & Mazhar (1964); Heemstra (1973); Baranes & Ben-Tuvia (1978).

Remarks: This species was included in synonymy of M. punctulatus by Fowler (1941) and generally confused with M. manazo or M. mustelus by various writers until Heemstra (1973) examined its type and concluded that it was a valid species. The heavy hypercalcification of the skeleton of adults of this species is unique in its genus and family, although other carcharhinoids have hypercalcified skeletons (see Compagno, 1979). With present evidence (Heemstra, 1973, pers. comm.), there seem to be isolated populations of this species off Natal, South Africa (the Mustelus species of Bass, D'Aubrey & Kistnasamy, 1975a, which Dr P.C. Heemstra identifies as M. mosis and which the writer has examined and skeletonized) in the Red Sea, and in the "Gulf" and Arabian Sea to southern India and Sri Lanka, though this may be an illusion of inadequate collecting. The writer examined a specimen labelled M. manazo in the Zoological Survey of India, illustrated by Day (1878), and found it to be M. mosis. A. Baranes of the Hebrew University of Jerusalem has done a study of the ecology and behaviour of this species in the Red Sea off Elat, Israel. In Israeli waters off Elat it is called the Moses smooth-hound and off South Africa, the hardnose smooth-hound.

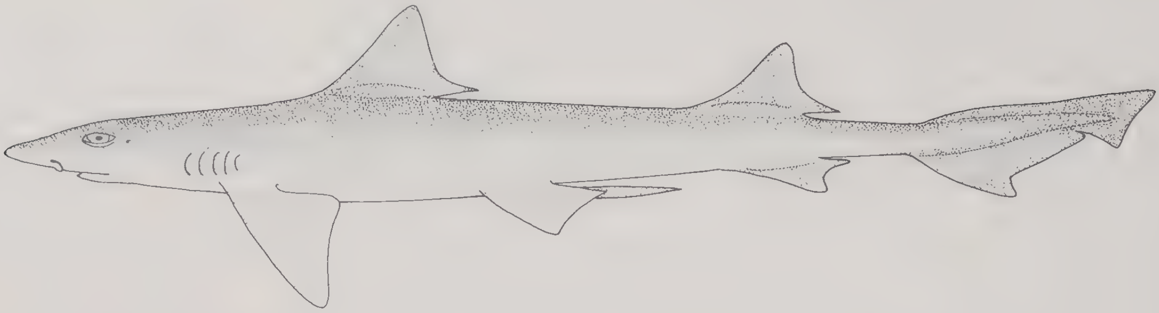
Mustelus mustelus (Linnaeus, 1758)

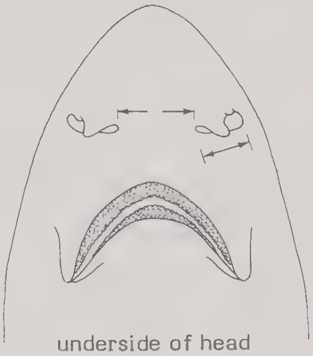
TRIAK Must 1

Squalus mustelus Linnaeus, 1758, Syst.Nat., ed. 10, 1:235. Holotype: None. Type Locality: "Habitat in Europa".

Synonymy: Mustelus laevis Linck, 1790; ? Mustelus vulgaris Cloquet, 1821; Mustellus levis Risso, 1826; Mustelus equestris Bonaparte, 1834 (in part; also M. asterias).

FAO Names : En - Smooth-hound; Fr - Emissole lisse; Sp - Musola.





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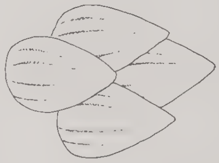
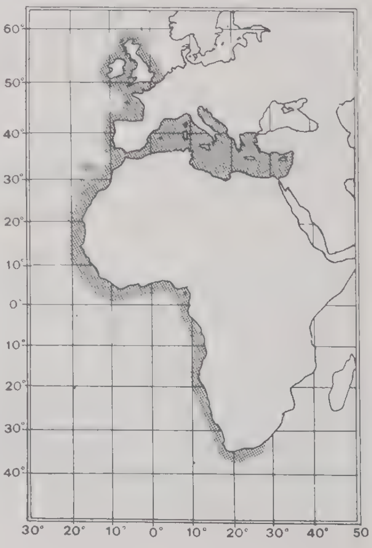


dermal denticles

Field Marks : A usually unspotted, large Mustelus with a short head and snout, broad internarial space, large eyes, narrow interorbital space, upper labial furrows slightly longer than lowers, low-crowned teeth with weak cusps, buccopharyngeal denticles confined to extreme front of mouth, lateral trunk denticles usually lanceolate and with complete ridges, unfringed dorsal fins, 70 to 93 precaudal centra, and a semifalcate ventral caudal lobe. It is the only smooth-hound with the above characters where it occurs.

Diagnostic Features : Body fairly slender. Head short, prepectoral length 17 to 21% of total length; snout moderately long and bluntly angular in lateral view, preoral snout 5.3 to 7.4% of total length, preorbital snout 5.9 to 8% of total length; internarial space broad, 2.4 to 3% of total length; eyes fairly large, eye length about 1.9 to 2.8 times in preorbital snout and 2.3 to 4% of total length; interorbital space narrow, 3.7 to 4.8% of total length; mouth fairly short, length subequal to eye length and 2.2 to 3.5% of total length; upper labial furrows usually slightly longer than lowers and 1.4 to 2.1% of total length; teeth molariform and asymmetric, with cusp reduced to a low point, cusplets absent except in very young sharks; buccopharyngeal denticles confined to tongue tip and extreme anterior end of palate. Interdorsal space 18 to 25% of total length; trailing edges of dorsal fins denticulate, without bare ceratotrichia; first dorsal falcate, with posterior margin almost vertical, midbase closer to pectoral bases than pelvics; pectoral fins moderately large, length of anterior margins 13 to 17% of total length, width of posterior margins 8.2 to 14% of total length; pelvic fins moderately large, anterior margin 6.5 to 9.9% of total length; anal height 2.4 to 4.3% of total length; anal caudal space greater than second dorsal height, and 6.3 to 8.8% of total length; ventral caudal lobe more or less falcate in adults. Crowns of lateral trunk denticles lanceolate or weakly tricuspidate, with longitudinal ridges extending their entire length. Cranium and hyomandibulae not hypercalcified in adults, but scapulocoracoid tips, distal pectoral radials, and hypochordal arches sometimes slightly hypercalcified; palatoquadrates not subdivided; monospondylous precaudal centra 25 to 32, diplospondylous precaudal centra 40 to 66, precaudal centra 70 to 93. Colour uniform grey or grey-brown, above, light below, no white spots or dark bars, some specimens with dark spots. Development viviparous. Size large, adults 70 to at least 164 cm.

Geographical Distribution : Eastern Atlantic: France and British Isles to Mediterranean, Morocco, Canary Islands, Madeira, Angola, South Africa.



Habitat and Biology : An abundant shark of the continental shelves and uppermost slopes, most commonly found in shallow water at depths from 5 to 50 m, but often in the intertidal region and ranging to at least 350 m depth; sometimes in midwater but prefers to swim near the bottom.

Viviparous, with a yolk-sac placenta; number of young 4 to 15 per litter. Gestation period about 10 to 11 months.

Primarily a crustacean feeder that eats crabs, lobsters, slipper lobsters, hermit crabs, and shrimps, but also cephalopods (including octopi) and bony fishes (including snake eels). A deep-caught individual (300 m) had a midwater fish (greeneye, Chlorophthalmus) in its stomach.

Size : Maximum 164 cm, males maturing between 70 and 74 cm and reaching at least 110 cm, females maturing at about 80 cm and reaching at least 164 cm. Size at birth about 39 cm.

Interest to Fisheries: Fisheries exist for this species in European waters, the Mediterranean, and off West Africa: this shark is very common and is taken in bottom trawls, fixed bottom nets, with line gear, and occasionally even in pelagic trawls. It is utilized fresh and fresh-frozen for human consumption (France, Federal Republic of Germany, Italy), also dried salted and smoked; its liver is used for oil and carcasses for fishmeal. In South Africa, it is commonly taken by sportsfishers from shore on sandy beaches.

Literature: Lozano y Rey (1928); Springer (1939); Bigelow & Schroeder (1948); Poll (1951); Tortonese (1956); Cadenat (1957); Quignard & Capape (1972); Heemstra (1973); Wheeler (1978); Compagno (1981); Cadenat & Blache (1981); L.J.V. Compagno & M. Smale, unpub. data.

Remarks: This species is very close to M. canis of the western Atlantic and has been sometimes confused with it, but, according to Heemstra (1973), it differs in having somewhat shorter upper labial furrows, a narrower internarial, and fewer vertebrae.

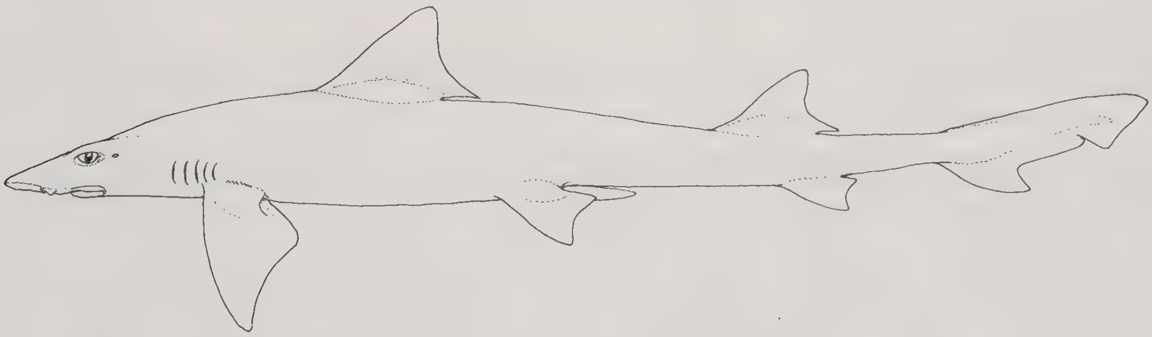
Mustelus norrisi Springer, 1940

TRIAK Must 16

Mustelus norrisi Springer, 1940, Proc.U.S.Natl.Mus., 86(3058):462, figs 53, 55. Holotype: US National Museum of Natural History, USNM 107739, 723 mm adult male. Type Locality: Off Englewood, Florida

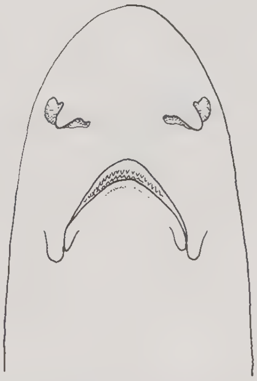
Synonymy: None.

FAO Names: En - Narrowfin smooth-hound; Fr - Emissole veuve; Sp - Musola viuda.



Field Marks: An unspotted Mustelus with a short, narrow head, narrow internarial space, relatively large eye, long mouth, upper labial furrows shorter than lowers, strongly falcate fins and 87 to 100 precaudal vertebral centra.

Diagnostic Features: Body fairly slender. Head short, prepectoral length 16 to 20% of total length; snout moderately long and bluntly angular in lateral view, preoral snout 4.2 to 6.5% of total length, preorbital snout 5.9 to 7.2% of total length; internarial space narrow, 2.3 to 2.9% of total length; eyes fairly large, eye length 2.1 to 2.7 times in preorbital snout and 2.3 to 3.4% of total length; interorbital space narrow, 3.3 to 4.2% of total length; mouth length greater than eye length, and 2.5 to 3.7% of total length; upper labial furrows as long as lowers and 1 to 1.7% of total length; teeth molariform and asymmetric, with cusp reduced to a low point; buccopharyngeal denticles covering anterior half of palate and floor of mouth. Interdorsal space 18 to 26% of total length; trailing edges of dorsal fins denticulate, without bare ceratotrichia; first dorsal falcate, with posterior margin nearly vertical from apex, its midbase about equidistant between pectoral and pelvic bases; pectoral fins fairly small, length of anterior margins 12 to 15% of total length, width of posterior margin 7.9 to 12% of total length; pelvic fins fairly small, length of anterior margins 6.7 to 8.5% of total length; anal height 2.6 to 3.7% of total length; anal-caudal space greater than second dorsal height, and 7.3 to 9.7% of total length; ventral caudal lobe strongly falcate in adults. Crowns of lateral trunk denticles lanceolate, with longitudinal ridges extending their entire length. Skeleton not hypercalcified in adults; palatoquadrates not subdivided; monospondylous precaudal centra 33 to 38, diplospondylous precaudal centra 54 to 65, precaudal centra 87 to 100. Colour uniform grey above, light below, no white or dark spots or dark bars, but tips of dorsal and caudal fins dusky in newborn young. Development viviparous. Size moderately large, adults 50 to 100 cm.



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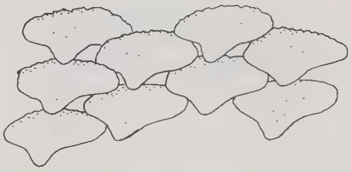
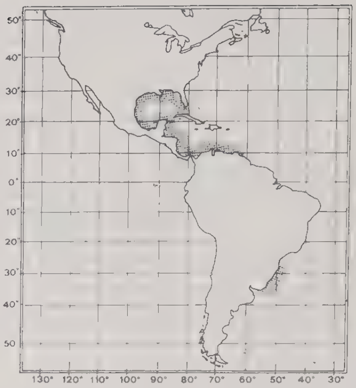


lower teeth



Geographical Distribution : Western Atlantic: Florida and northern Gulf of Mexico to Venezuela; southern Brazil.

Habitat and Biology : A common tropical-subtropical bottom-dwelling shark of the continental shelves, found on sand and mud bottoms from close inshore to at least 80 m depth. The species is thought to be migratory in the Gulf of Mexico, moving inshore into water shallower than 55 m in the winter months and apparently retreating into deeper water in other seasons (Heemstra, 1973).

Viviparous, with a yolk-sac placenta; number of young 7 to 14 per litter.

Eats mostly crabs and shrimp, but also small bony fishes.

Size : Maximum about 100 cm, males maturing at about 58 cm, females at about 65 cm; size at birth 30 cm.

Interest to Fisheries : Probably regularly taken within its range, but details of commercial fisheries are lacking.

Literature : Springer (1939); Clark & von Schmidt (1965); Cervigón (1966); Heemstra (1973).

Remarks : Close to the larger, stockier Mustelus canis, and compared with it under that species. See Heemstra (1973) for a discussion of the characters separating the two species.

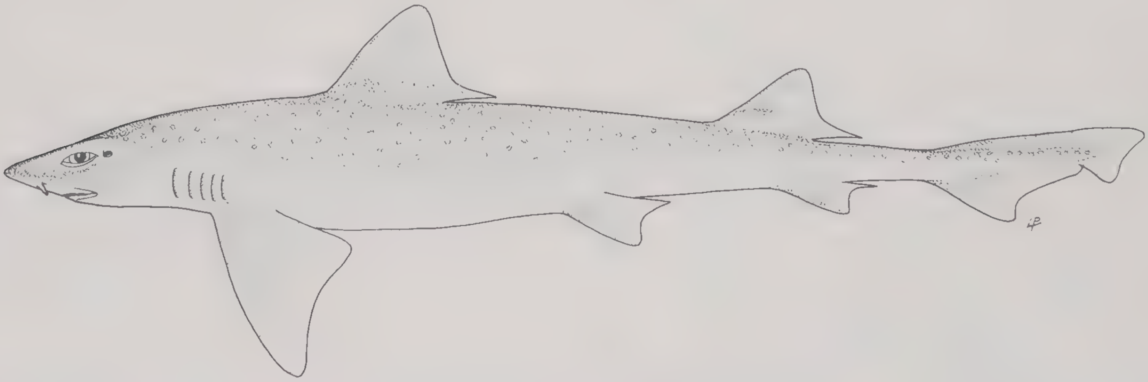
Mustelus palumbes Smith, 1957

TRIAK Must 17

Mustelus palumbes Smith, 1957, S.Afr.J.Sci, 53:358, figs 2E-F. Holotype: J.L.B. Smith Institute of Ichthyology, Grahamstown, South Africa, RUSI 24, 990 mm female (head, tail, and fins preserved). Type Locality: Knysna estuary mouth, South Africa, in shallow water.

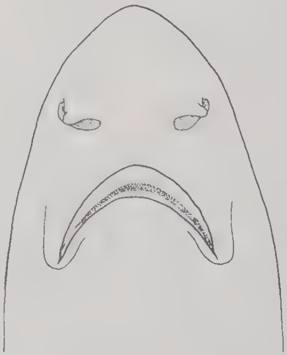
Synonymy : None

FAO Names : En - Whitespotted smooth-hound; Fr - Emissole palombe; Sp - Musola paloma.



Field Marks : A fairly large, usually white-spotted Mustelus with a relatively broad internarial space, buccopharyngeal denticles covering almost entire oral cavity, unfringed dorsal fins, relatively large pectoral and pelvic fins, and 74 to 88 precaudal centra. It is the only white-spotted smooth-hound in southern African waters.

Diagnostic Features : Body fairly slender. Head short, prepectoral length 17 to 21% of total length; snout moderately long and bluntly angular in lateral view, preoral snout 6 to 7.4% of total length, preorbital snout 6.1 to 7.5% of total length; internarial space broad, 2.4 to 3% of total length; eyes fairly large, eye length 1.7 to 2.4 times in preorbital snout and 2.8 to 4% of total length; interorbital space moderately narrow, 3.7 to 4.7% of total length; mouth short, subequal to eye length and 2.6 to 3.3% of total length; upper labial furrows longer than lowers and 1.7 to 2.5% of total length; teeth



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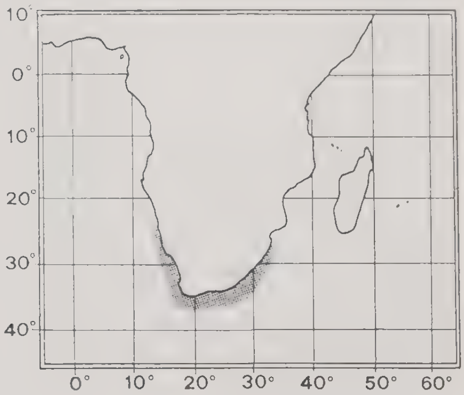
molariform and asymmetric, with cusp reduced to a low point, cusplets absent except in very young sharks; buccopharyngeal denticles covering almost entire palate and floor of mouth. Interdorsal space 18 to 23% of total length; trailing edges of dorsal fins denticulate, without bare ceratotrichia; first dorsal broadly triangular, with posteroventrally sloping posterior margin, its midbase closer to pectoral bases than pelvics; pectoral fins large, length of anterior margins 14 to 18% of total length, width of posterior margin 12 to 16% of total length; pelvic anterior margins 6.4 to 9.3% of total length; anal height 3.2 to 4.1% of total length; anal-caudal space greater than second dorsal height, and 7 to 8.8% of total length; ventral caudal lobe somewhat expanded and sometimes semi falcate in adults. Crowns of lateral trunk denticles lanceolate or weakly tricuspidate, with longitudinal ridges confined to their anterior halves or extending their entire length. Skeleton not hypercalcified in adults; palatoquadrates not subdivided; monospondylous precaudal centra 36 to 40, diplospondylous precaudal centra 43 to 52, precaudal centra 74 to 88. Colour uniform grey or grey-brown above, light below, usually with numerous small white spots but no dark spots or dark bars. Development ovoviviparous. Size large, adults 76 to 120 cm.

Geographical Distribution : Eastern South Atlantic and southwestern Indian Ocean: Namibia, South Africa and extreme southern Mozambique.



Habitat and Biology : A common inshore and offshore temperate-water shark of the continental shelf and upper slope, on or near bottom at depths from the intertidal region down at least to 360 m depths. Prefers sand and gravel bottoms.

Ovoviviparous, without a yolk-sac placenta; number of young 3 to 8 per litter. Eats crabs and probably other invertebrates.

Size : Maximum about 120 cm; adults females 79 to 102 cm, adult males 76 to 88 cm.

Interest to Fisheries : Limited, often taken by sports anglers and by commercial bottom trawlers, but usually discarded although excellent eating. Some may be utilized in a local fishery that processes sharks for 'biltong', dried shark meat or jerky, for human consumption.

Literature : Heemstra (1973, and pers. comm.); L.J.V. Compagno & M. Smale, unpub. data.

Remarks : In its range, this species is primarily sympatric with the unspotted or dark-spotted Mustelus mustelus, which differs in its shorter labial furrows that are only slightly longer than the lowers, slightly smaller pectoral fins, less extensive buccopharyngeal denticles, more falcate fins, and less numerous monospondylous precaudal centra. The unspotted, more tropical M. mosis of the western Indian Ocean overlaps its northeastern range of Natal, South Africa, and differs in having smaller upper labial furrows subequal to the lowers, smaller pectorals, less extensive buccopharyngeal denticles, and a strongly hypercalcified skeleton. Of closely similar, Eastern Hemisphere white-spotted species M. manazo differs in being smaller and in having smaller paired fins; M. lenticulatus and M. antarcticus have less extensive buccopharyngeal denticles; and M. asterias has smaller paired fins, a narrower internarial, and somewhat more vertebrae.

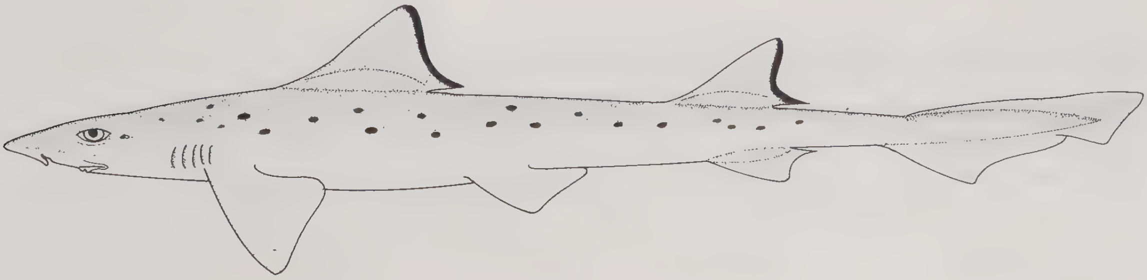
Mustelus punctulatus Risso, 1826

TRIAK Must 18

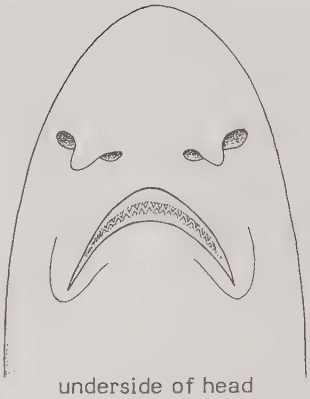
Mustellus punctulatus Risso, 1826, Hist.Nat.princ.prod.Europe Mered., 3:128. Holotype: Female of 640 mm, lost? Type Locality: ? Nice, France, Mediterranean Sea.

Synonymy : Mustelus mediterraneus Quignard & Capape, 1972.

FAO Names : En - Blackspotted smooth-hound; Fr - Emissole pointillée; Sp - Musola pimienta.



Field Marks: A usually black-spotted smallish Mustelus with a short head and snout, narrow head and internarial, large eyes, upper labial furrows somewhat longer than lowers, low-crowned teeth with weak cusps, buccopharyngeal denticles confined to front of mouth, lanceolate lateral trunk denticles with incomplete ridges, and prominently fringed dorsal fins.



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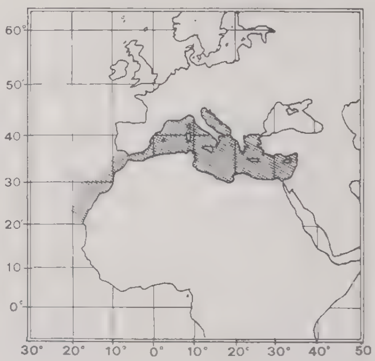
Diagnostic Features: Body fairly slender. Head short, prepectoral length 17 to 20% of total length; snout moderately long and bluntly angular in lateral view, preoral snout 5.6 to 7.5% of total length, preorbital snout 6.1 to 7.3% of total length; internarial space narrow, 1.9 to 2.3% of total length; eyes fairly large, eye length 2.1 to 2.8 times in preorbital snout and 2.3 to 3.6% of total length; interorbital space, 3.7 to 4.4% of total length; mouth short, subequal to eye length and 2 to 3.1% of total length; upper labial furrows definitely longer than lowers and 1.7 to 2.2% of total length; teeth molariform and asymmetric, with cusp reduced to a low point; distal cusplets absent except in very young sharks; buccopharyngeal denticles confined to tongue and anterior third of palate. Interdorsal space 18 to 22% of total length; trailing edges of dorsal fins naked, with a prominent band of dark, bare ceratotrichia; first dorsal broadly triangular, with posteroventrally sloping posterior margin, its midbase closer to pelvic bases than to pectorals; pectoral fins fairly small, anterior margin lengths 12 to 14% of total length, width of posterior margins 7.2 to 11% of total length; pelvic fins small, anterior margin length 7.4 to 8.8% of total length; anal height 2.3 to 3.4% of total length; anal-caudal space greater than second dorsal height, and 6 to 8.2% of total length; ventral caudal lobe falcate in adults. Crowns of lateral trunk denticles lanceolate, with or without weak ridges that, when present, extend at most only half their length. Cranium, hyomandibulae, and scapulocoracoids not hypercalcified in adults; palatoquadrates not subdivided; monospondylous precaudal centra 32 to 37, diplospondylous precaudal centra 41 to 50, precaudal centra 78 to 84. Colour uniform grey or grey-brown above, light below, often with small black spots but without white or dark bars. Development uncertain. Size moderate, adults 50 to 90 cm.

Geographical Distribution: Eastern North Atlantic: Western Sahara, Mediterranean.



Habitat and Biology: An inshore, continental bottom-dwelling shark. Habits are little known because of confusion with the more common Mustelus mustelus, but presumably this species is viviparous. Data for Mustelus mediterraneus may apply in part to this species; this suggests a gestation period of about a year and a maturation time of 1 to 2 years, although this remains to be confirmed from direct ageing methods. Probably a crustacean-feeder.

Size: Maximum at least 95+ cm, males mature at 50 to 55 cm, females at about 60 cm; size at birth about 31 cm.

Interest to Fisheries: Probably regularly captured and utilized for human consumption in the Mediterranean, but details not certain because of confusion of this species with M. mustelus.

Literature: Quignard & Capape (1972); Heemstra (1973); Compagno (1981); Francis (1981).

Remarks: See Heemstra (1973) for a discussion of the systematics and nomenclature of this species. Previously, Quignard & Capape (1972) had described a new species, Mustelus mediterraneus, which Heemstra considers in part referable to M. punctulatus.

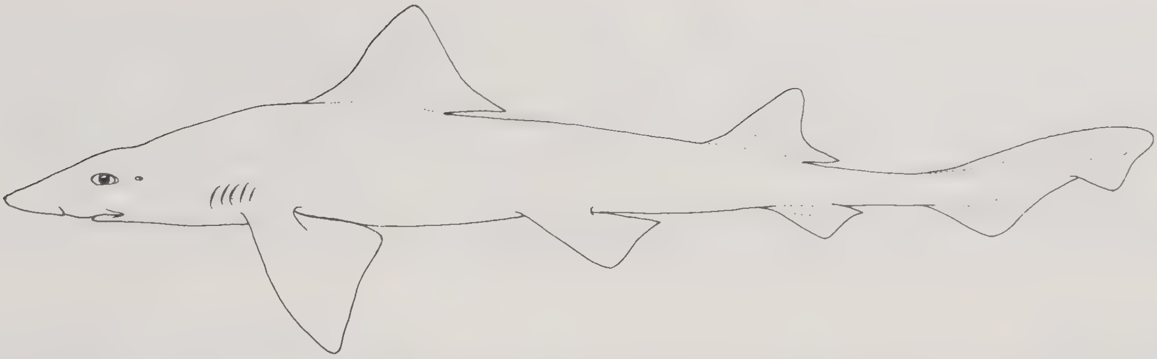
Mustelus schmitti Springer, 1940

TRIAK Must 19

Mustelus schmitti Springer, 1940, Proc.U.S.Natl.Mus., 86(3058):465. Holotype: U.S. National Museum of Natural History, USNM 107740, 742 mm adult male. Type Locality: Off coast of Uruguay.

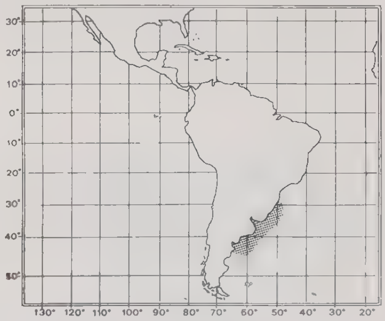
Synonymy: None.

FAO Names: En - Narrownose smooth-hound; Fr - Emissole gatuso; Sp - Musola gatusa.



Field Marks: A white-spotted Mustelus with a very narrow internarial space and dorsal fins with naked ceratotrichia on margins.

Diagnostic Features: Body fairly slender. Head short, prepectoral length 17 to 21% of total length; snout moderately long and bluntly angular in lateral view, preoral snout 5.7 to 7.4% of total length, preorbital snout 5.8 to 7.8% of total length; internarial space very narrow, 1.8 to 2.4% of total length; eyes fairly large, eye length 2 to 3.1 times in preorbital snout and 2.1 to 3.5% of total length; interorbital space fairly narrow, 4.3 to 5.3% of total length; mouth short, subequal to eye length and 2.3 to 3.2% of total length; upper labial furrows considerably longer than lowers and 1.8 to 2.6% of total length; teeth molariform and asymmetric, with cusps low and rounded; buccopharyngeal denticles not known. Interdorsal space 17 to 23% of total length; trailing edges of dorsal fins naked, with a band of bare ceratotrichia; first dorsal broadly triangular, with posteroventrally sloping posterior margin, its midbase closer to pelvic bases than to pectorals; pectoral fins fairly small, length of anterior margins 12 to 16% of total length, width of posterior margin 8.6 to 13% of total length; pelvic fins small, anterior margin length 6.7 to 8.7% of total length; anal height 2.5 to 3.5% of total length; anal caudal space slightly greater or subequal to second dorsal height, and 5.8 to 7.8% of total length; ventral caudal lobe not expanded and falcate in adults. Crowns of lateral trunk denticles lanceolate, with longitudinal ridges extending at least half their length. Cranium, hyomandibulae, scapulocoracoids not hypercalcified in adults; palatoquadrates not subdivided; monospondylous precaudal centra 36 to 39, diplospondylous precaudal centra 45 to 54, precaudal centra 82 to 88. Colour grey above, light below, often with numerous white spots but no dark spots or dark bars. Development ovoviviparous. Size moderate, adults 48 to 74 cm.



Geographical Distribution: Western South Atlantic: Southern Brazil to northern Argentina.

Habitat and Biology: A common bottom-dwelling shark of the continental shelf of Atlantic South America, at depths of 60 to 195 m. Ovoviviparous, without a placenta, 2 to 7 pups per litter. Eats crabs and probably other crustacea, and presumably small fishes.

Size: Maximum at least 74 cm; males maturing at about 48 cm and females at about 55 to 60 cm; size at birth 26 cm.

Interest to Fisheries: An important fishery for this species exists off Argentina, 9000 metric tons catch being reported for 1975 and 5981 metric tons for 1978 (FAO Yearbook of Fishery Statistics, 1978). The species is also regularly caught off Uruguay, and utilized there for meat (marketed fresh and dried salted for human consumption) and oil.

Literature: Springer (1939); Bigelow & Schroeder (1940, 1948); Heemstra (1973).

Remarks: A distinctive species, not close to any of the other white-spotted ovoviviparous smooth-hounds.

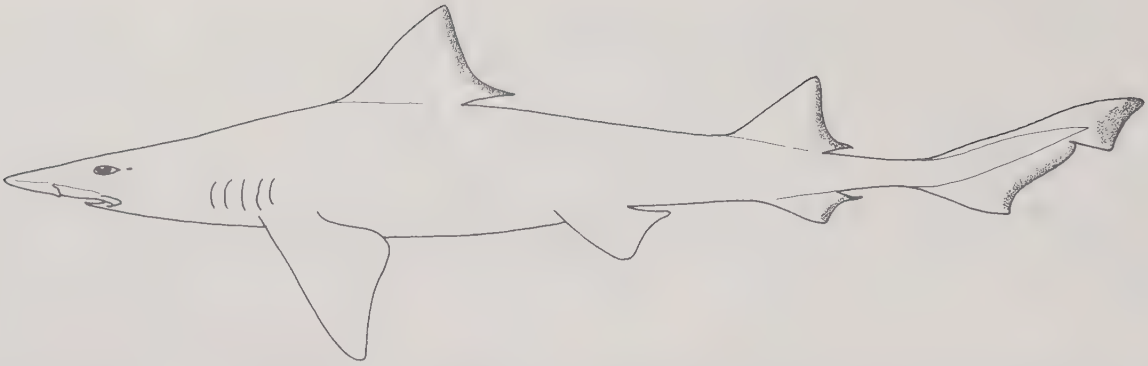
Mustelus whitneyi Chirichigno, 1973

TRIAK Must 20

Mustelus whitneyi Chirichigno, 1973, Inf.Inst.Mar, Peru, (42):1, 6-7, figs 1-3. Holotype: Instituto del Mar del Peru, IMARPE 1210, 645 mm adult male. Type Locality: Off Paita, Peru, 92 m depth.

Synonymy: None.

FAO Names: En - Humpback smooth-hound; Fr - Emissole piruche; Sp - Musola prieta.



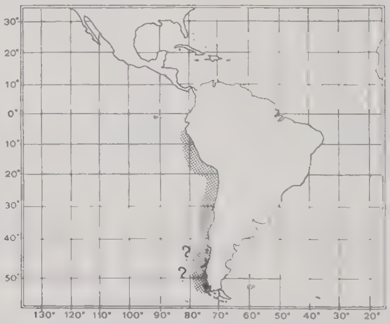
Field Marks: An unspotted, grey, rather stocky Mustelus with strongly cuspidate teeth, lanceolate denticles, short caudal peduncle, and broadly frayed posterior dorsal fin margins.

Diagnostic Features: Body fairly stocky, almost humpbacked. Head fairly long, prepectoral length 20 to 24% of total length; snout moderately long and bluntly angular in lateral view, preoral snout 5.6 to 7.6% of total length, preorbital snout 6.7 to 8.5% of total length; internarial space very broad, 2.9 to 3.7% of total length; eyes fairly large, eye length 2 to 3.1 times in preorbital snout and 2.1 to 3.2% of total length; interorbital space moderately broad, 4.5 to 5.6% of total length; mouth moderately long, slightly longer than eye length and 2.6 to 3.7% of total length; upper labial furrows considerably longer than lowers and 2.6 to 3.7% of total length; teeth cuspidate and asymmetric, with a prominent primary cusp and low cusplets occasionally present; buccopharyngeal denticles confined to anterior fourth of palate and tongue tip. Interdorsal space 16 to 21% of total length; trailing edges of dorsal fins naked, with a conspicuous dark margin of bare ceratotrichia; first dorsal broadly triangular, with posteroventrally sloping posterior margin, midbase closer to pelvic bases than pectorals; pectoral fins fairly large, length of anterior margins 14 to 17% of total length, width of posterior margins 11 to 14% of total length; pelvic fins moderately large, length of anterior margins 7.1 to 9.4% of total length; anal fin height 2.3 to 3.8% of total length; anal-caudal space less than or subequal to second dorsal height, and 4.7 to 7.4% of total length; ventral caudal lobe hardly falcate in adults. Crowns of lateral trunk denticles lanceolate, with longitudinal ridges extending their entire length. Skeleton not hypercalcified in adults; palatine processes of palatoquadrates usually subdivided at symphysis, with a short separate medial segment on each side; monospondylous precaudal centra 36 to 41, diplospondylous precaudal centra 47 to 55, precaudal centra 86 to 93. Colour uniform grey or grey-brown above, lighter below, no white or dark spots or dark bars. Development viviparous. Size moderate, adults 68 to 87 cm.

Geographical Distribution: Eastern South Pacific: Peru to southern Chile.

Habitat and Biology: A common offshore bottom-dwelling shark of the Pacific South American continental shelf, at depths of 16 to 211 m, but most common at 70 to 100 m. Prefers rocky bottom around islands. Viviparous, with 5 to 10 young per litter. Eats crabs, manis shrimp, and small bony fishes.

Size: Maximum at least 87 cm (adult female), smallest adult male 68 cm, smallest adult female 74 cm; size at birth about 25 cm.



Interest to Fisheries: A common species off Peru, and probably figuring in the landings of species of "tollo" there.

Literature: Kato, Springer & Wagner (1967); Chirichigno (1973); Heemstra (1973).

Scylliogaleus Boulenger, 1902

TRIAK Scyl

Genus: Scylliogaleus Boulenger, 1902, Ann.Mag.Nat.Hist., ser. 7, 10(55):51.

Type Species: Scylliogaleus quecketti Boulenger, 1902, by monotypy.

Synonymy: None.

Diagnostic Features: Snout short and broadly rounded in dorsoventral view, preoral length 0.7 to 0.9 times mouth width; eyes horizontally elongated and dorsolateral, subocular ridges strong; anterior nasal flaps triangular, greatly expanded posteriorly and medially, nearly meeting each other medially and overlapping mouth posteriorly; broad, shallow nasoral grooves present between excurrent apertures of nostrils and mouth; internarial width about half of nostril width; mouth broadly arched and short; labial furrows long, uppers reaching level of upper symphysis; teeth deep, blunt-crowned, molariform, and without cusps and cusplets; medial teeth not differentiated from anteroposteriors. First dorsal fin moderately large, base about 3/5 of dorsal caudal margin; its origin over pectoral inner margins or free rear tips, its midbase about equidistant between pectoral and pelvic bases or slightly closer to pelvic bases; second dorsal about as large as first, height over 3/4 as high as first; anal fin considerably smaller than second dorsal; ventral caudal lobe hardly developed in young but very short in adults; terminal lobe of caudal fin moderately long and about 2.8 to 3.2 times in dorsal caudal margin.

Remarks : This genus is occasionally placed in its own family, with or without Mustelus, because of its molariform teeth, but it otherwise is close to other triakids while differing from all of them in having expanded anterior nasal flaps and nasoral grooves. For further discússion of its systematic position see Compagno (1979).

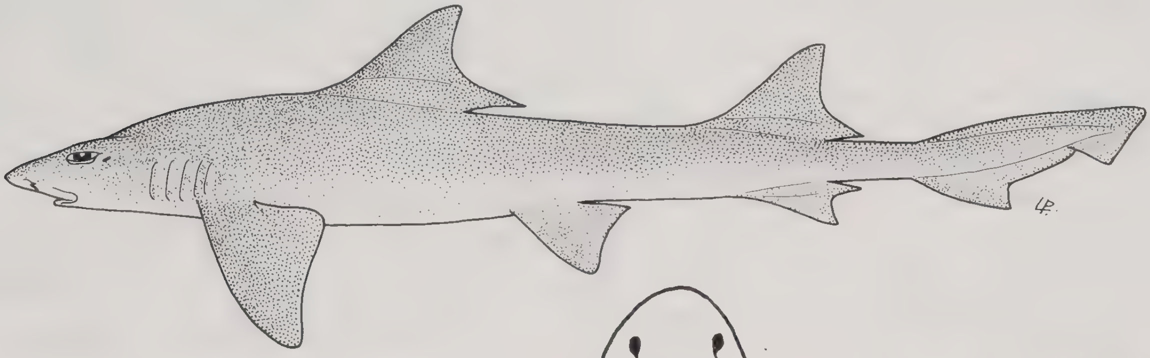
Scylliogaleus quecketti Boulenger, 1902

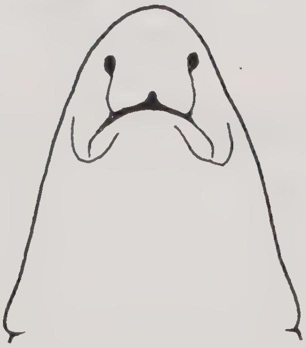
TRIAK Scyl 1

Scylliogaleus quecketti Boulenger, 1902, Ann.Mag.Nat.Hist., ser. 7, 10(55):51, pl. 4. Holotype: British Museum (Natural History), BMNH 1903.2.6.21, 340 mm immature male. Type Locality: Off rocks at Umkomaas, Natal, South Africa.

Synonymy : None.

FAO Names : En - Flapnose houndshark; Fr - Virli à clapet; Sp - Cazón mosqueador.





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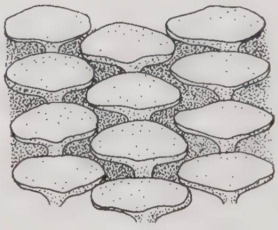
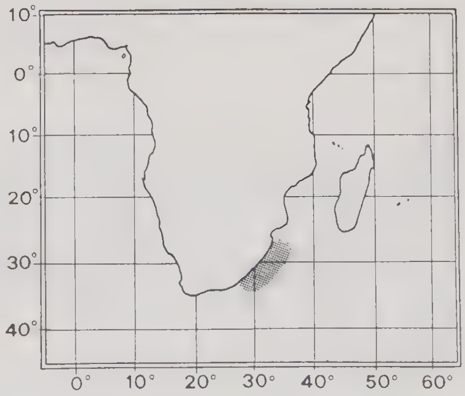


teeth

Field Marks : A houndshark with a blunt short snout, enlarged anterior nasal flaps that are expanded medially and posteriorly to cover mouth, nasoral grooves, molariform teeth, and the second dorsal fin about as large as first and much larger than the anal fin.

Diagnostic Features : See genus.

Geographical Distribution : Western Indian Ocean: South Africa (Natal and northeastern Cape Province).



Habitat and Biology : An inshore warm-temperate or subtropical shark of continental waters, found at the surfline and close offshore. Viviparous, with presence or absence of placenta uncertain; size of litters 2 to 4 (usually 2 or 3). Gestation period 9 to 10 months. Feeds primarily on crustaceans (including lobsters), also squid.

Size : Maximum 102 cm, adult males 70 to 89 cm, adult females 80 to 102 cm; size at birth about 34 cm.

Interest to Fisheries : None or minimal, caught by surf anglers.

Literature : Bass, D'Aubrey & Kistnasamy (1975b); Compagno (1979).

Triakis Müller & Henle, 1838

TRIAK Triak

Genus : *Triakis* Müller & Henle, 1838, *Mag.Nat.Hist.*, 2, n. ser.:36 (no species named).

Type Species : *Triakis scyllium* Müller & Henle, 1839, by subsequent monotypy.

Synonymy : Genus *Triacis* Gill, 1862 (emended spelling); Subgenus *Cazon* de Buen, 1959 (Genus *Mustelus* Linck, 1790).

Field Marks : Usually stout-bodied houndsharks with short snouts, dorsolateral eyes and strong subocular ridges, broadly arched mouths, teeth formed into a semipavement or not, with cusps and cusplets variably developed but present on at least more medial teeth, medial teeth not differentiated from anterolaterals, second dorsal fin nearly as large as first, and ventral caudal lobe short but strong in adults.

Diagnostic Features : Snout short and broadly rounded in dorsoventral view, preoral length less than 1.1 times mouth width; eyes horizontally elongated and dorsolateral, subocular ridges strong; anterior nasal flaps elongated and lobate, well separated from each other and mouth; no nasoral grooves; internarial width about 1.5 to 2 times the nostril width; mouth broadly arched and moderately short; labial furrows long, uppers nearly or quite reaching level of upper symphysis; teeth semibladelike, somewhat compressed, and similar in both jaws, usually with erect or oblique cusps (sometimes absent from posterior teeth) and variably developed cusplets; medial teeth not differentiated from anteroposteriors. First dorsal fin moderately large, base less than 3/4 of dorsal caudal margin; its origin over pectoral inner margins, its midbase about equidistant between pectoral and pelvic bases or slightly closer to pelvic bases; second dorsal nearly as large as first, height about 3/4 as high as first; anal fin considerably smaller than second dorsal; ventral caudal lobe hardly developed in young but short and strong in adults; terminal lobe of caudal fin moderately long and about 2.5 to 3 times in dorsal caudal margin.

Remarks : The present arrangement of *Triakis* follows the revisions of Compagno (1970, 1973a, b, c, 1979). The species form two well-defined subgenera, *Triakis* Müller & Henle, 1838 for *T. scyllium* and *T. semifasciata*, and Cazon de Buen, 1959 for *T. acutipinna*, *T. maculata* and *T. megalopterus*.

Key to Species :

1a. Body with a bold colour pattern of black saddles and a few large black spots on a grey background .... ***T. semifasciata***

1b. Body either without markings or with small black spots, or black spots and indistinct dusky saddles

  2a. Teeth strongly compressed and bladelike in sides of jaws, with oblique cusps and generally well-developed cusplets .... ***T. scyllium***

  2b. Teeth symmetrical or nearly so in sides of jaws, with erect cusps and cusplets low or absent

    3a. Pectoral fins narrowly falcate in adults. Black spots absent. Total vertebral counts 175 or 176 .... ***T. acutipinna***

    3b. Pectoral fins broadly triangular or broadly falcate in adults. Black spots often present on body. Total vertebral counts 162 to 170

      4a. Posterior margins of dorsal fins inclined posteroventrally from their apices .... ***T. maculata***

      4b. Posterior margins of dorsal fins vertical or nearly so .... ***T. megalopterus***

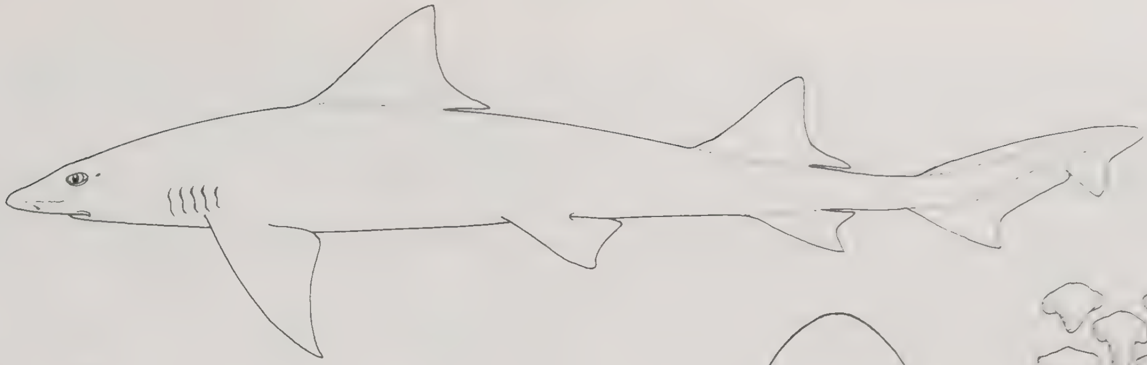
Triakis acutipinna Kato, 1968

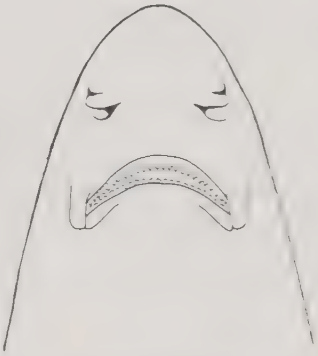
TRIAK Triak 1

Triakis acutipinna Kato, 1968, *Copeia*, 1968 (2):320, figs. 1-2. Holotype: U.S. National Museum of Natural History, USNM-201409, 1018 mm adult female. Type Locality: Isla de la Plata, Ecuador.

Synonymy : None.

FAO Names : En - Sharpfin houndshark; Fr - Virli équatorien; Sp - Tollo del Ecuador.





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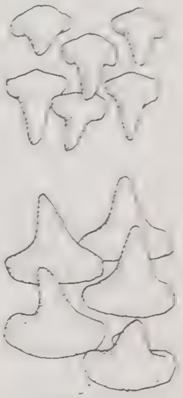


upper and lower teeth

Field Marks: A houndshark with a short broadly rounded snout, lobate anterior nasal flaps that do not reach the mouth and are far separated from each other, long upper labial furrows that reach the lower symphysis of the mouth, teeth not bladelike, with straight erect cusps and cusplets little-developed or absent, narrow fins with the pectorals narrowly falcate and the first dorsal fin with a vertical posterior margin, and no spots.

Diagnostic Features: Teeth with strong erect cusps on most teeth of the dental band except for some more distal teeth, cusplets low or absent on almost all teeth, semi-molariform but not bladelike. First dorsal fin with abruptly vertical posterior margin; pectoral fins narrowly falcate in adults. Total vertebral counts 175 or 176. Body without small black spots.

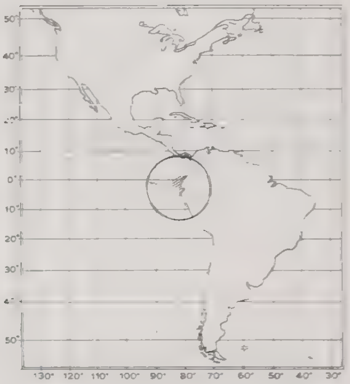
Geographical Distribution: Eastern South Pacific: Ecuador.

Habitat and Biology: A rare shark of tropical continental waters off Ecuador, known from two specimens. Biology virtually unknown.

Size: Maximum 102 cm (adult female), adult male 90 cm.

Interest to Fisheries: None at present.

Literature: Kato (1968); Compagno (1970, 1979).



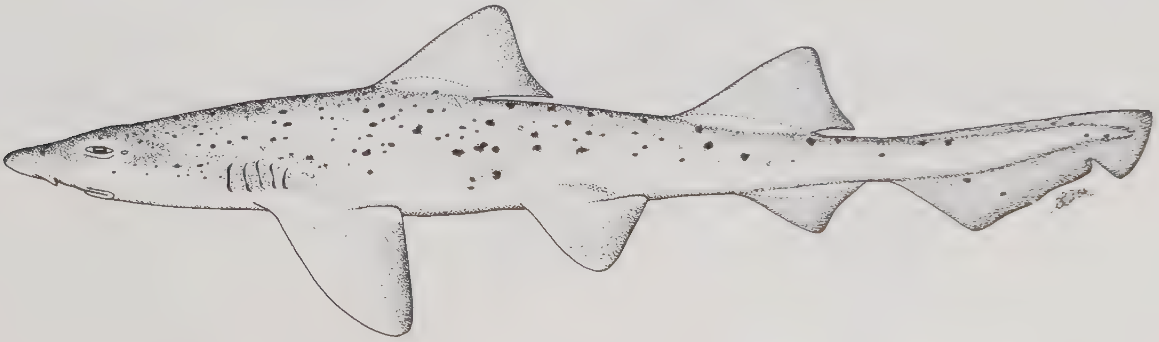
Triakis maculata Kner & Steindachner, 1866

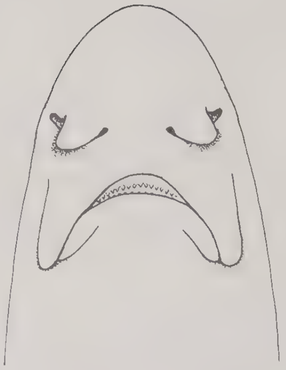
TRIAK Triak 2

Triakis maculatus Kner & Steindachner, 1866, Sitzber.Akad.Wiss.Wien, 54:391. Holotype: In Naturhistorisches Museum, Vienna? Type Locality: "Sudsee".

Synonymy: Mustelus nigromaculatus Evermann & Radcliffe, 1917.

FAO Names: En - Spotted houndshark; Fr - Virli tacheté; Sp - Tollo manchado.





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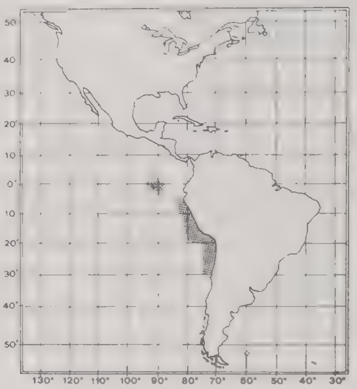
Field Marks : A very stout houndshark with a short, broadly rounded snout, lobate anterior nasal flaps that do not reach the mouth and are far separated from each other, long upper labial furrows that reach the lower symphysis of the mouth, teeth not bladelike, with straight erect cusps and cusplets little-developed or absent, broad fins with the pectorals broadly falcate and the first dorsal fin with a posteriorly sloping posterior margin, and usually with numerous black spots.

Diagnostic Features : Strong erect cusps on teeth of the middle two-thirds of the dental band, the more distal teeth having no cusp or weak ones, cusplets low or absent on almost all teeth, teeth semimolariform but not bladelike. First dorsal fin with posteroventrally sloping posterior margin; pectoral fins broadly falcate in adults. Total vertebral counts 164 to 170. Body usually with numerous small black spots, sometimes plain-coloured (plain females may have spotted young).

Geographical Distribution : Eastern Pacific: Peru to northern Chile, Galapagos Islands. Mexican records of this species are apparently erroneous.



Habitat and Biology : A little-known, inshore temperate-water shark of waters of the South American continental shelf. Probably ovoviviparous; one female had 14 young to a litter.

Size : Maximum size possibly 240 cm, otherwise 180 cm; full-term fetuses 30 to 40 cm, freeliving young 43 cm.

Interest to Fisheries : Taken in fisheries off Peru and probably also Chile, and used for human consumption.

Literature : Beebe & Tee-Van (1940); Hildebrand (1946); Kato, Springer & Wagner (1967); Compagno (1970, 1979); Heemstra (1973); Chirichigno (1978 and pers. comm.).

Remarks : The Galapagos record is from photographs of a specimen of this species that was caught, tagged and released off Isla Fernandina in 1980 (J.D. McCosker, pers.comm.).

Triakis megalopterus (Smith, 1849)

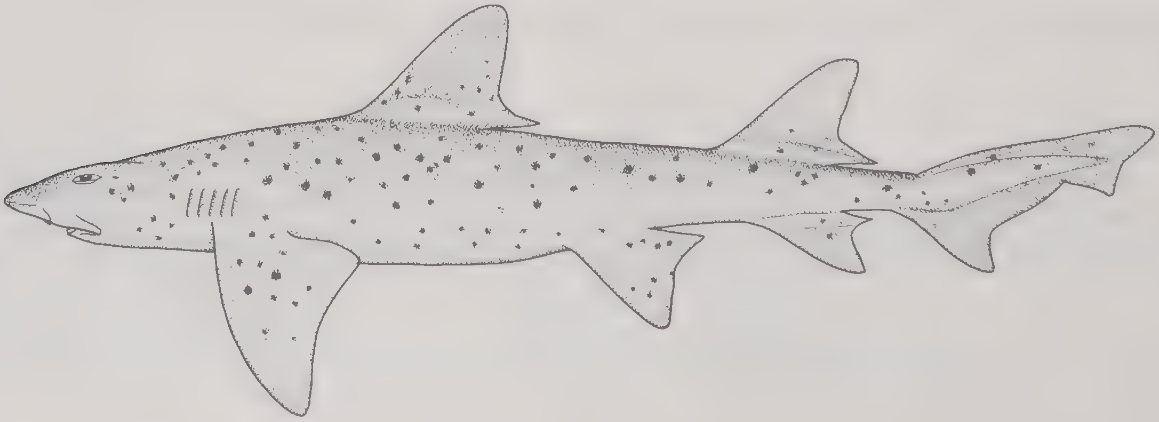
TRIAK Triak 3

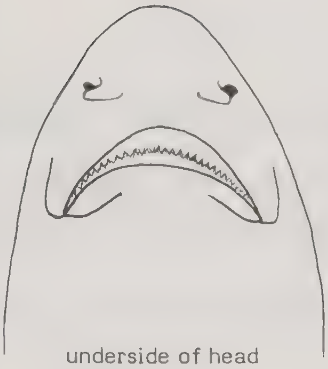
Mustelus megalopterus Smith, 1849, Pisces, Ill.zool.S.Africa, 4:4, pl. 2. Holotype: ? Type Locality: Cape of Good Hope, South Africa.

Synonymy : Mustelus natalensis Steindachner, 1866; Mustelus nigropunctatus Smith, 1952.

Other Scientific Names Recently in Use : Triakis natalensis (Steindachner, 1866).

FAO Names : En - Sharptooth houndshark; Fr - Virli dentu; Sp - Tollo dentudo.





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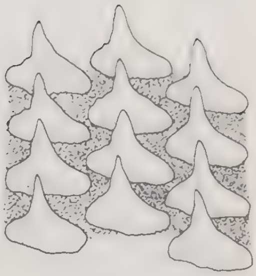
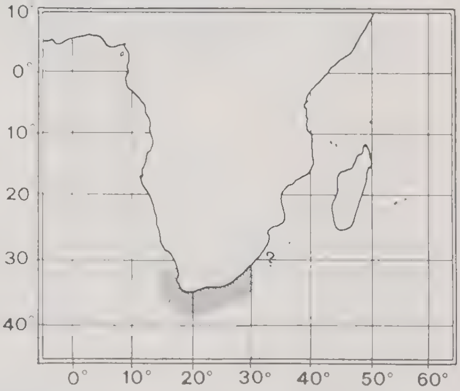


teeth

Field Marks: A very stout houndshark with a short, broadly rounded snout, lobate anterior nasal flaps that do not reach the mouth and are far separated from each other, long upper labial furrows that reach the lower symphysis of the mouth, semimolariform teeth with straight erect cusps and cusplets little-developed or absent, broad large fins with the pectorals broadly falcate and the first dorsal fin with a vertical posterior margin, and often black spots.

Diagnostic Features: Teeth with strong erect cusps on at least the middle two-thirds of the dental band but often not well developed on more distal teeth, cusplets low or absent on almost all teeth, semimolariform but not bladelike. First dorsal fin with abruptly vertical posterior margin; pectoral fins broadly falcate in adults. Total vertebral counts 162 to 166. Body with a few to numerous small black spots, few or absent in young, often numerous in adults although plain adults have been recorded.



Geographical Distribution: Eastern South Atlantic and western Indian Ocean: South Africa (Cape coast, rarely northeast to Natal).

Habitat and Biology: A common but little-known inshore bottom-dwelling shark of temperate continental waters, found often in shallow water up to the surfline. It prefers sandy shores and rocks and crevices in shallow bays. During summertime this shark congregates in schools, particularly in False Bay, western Cape, South Africa, which may have many pregnant females.

The sharptooth houndshark is hardy and keeps well in captivity. Observations by the writer of healthy individuals in a large circular tank at the Port Elizabeth Oceanarium, South Africa, shows them to be very active, mostly bottom swimmers, that are usually seen patrolling in irregular patterns close to the bottom in open, flat areas, often with a centimetre or less between the shark's underside and the substrate; they sometimes swim in midwater, but often close to the sides of the tank rather than in the open areas favoured by tope sharks, Galeorhinus galeus, in the same tank.

Ovoviviparous, without a yolk-sac placenta; number of young 6 to 12 per litter.

Eats crabs, bony fishes and small sharks (one had eaten a Scyliorhinus capensis).

Size: Maximum to at least 174 cm; males adolescent at 94 to 130 cm and adult at 140 to 142 cm or more; females maturing between 140 and 150 cm, with adults reported at 140 to 174 cm; size at birth about 30 to 32 cm.

Interest to Fisheries: Very commonly caught by rock and surf sports anglers, but not eaten much although perfectly edible. There is a fairly large commercial shark fishery in Gans Bay in South Africa that probably takes this species along with others; the meat of such sharks is dried into shark 'biltong' or jerky, which sells for a relatively high price.

Literature: Smith (1952); Compagno (1970, 1973c, 1979); Heemstra (1973); Bass, D'Aubrey & Kistnasamy (1975b); van der Elst (1981); L.J.V. Compagno and M. Smale (unpub. data).

Remarks: Placement and synonymy of this species follows Compagno (1973c, 1979), Heemstra (1973), and Bass, D'Aubrey & Kistnasamy (1975b). Bass, D'Aubrey & Kistnasamy (1975b) recognized Triakis natalensis as a separate species based on its better developed cusplets on its teeth and plain coloration, but examination of material of T. megalopterus in the J.L.B. Smith Institute of Ichthyology confirmed the writer's earlier opinion (Compagno, 1979), that the two are synonyms. The characters of natalensis are apparently best considered as juvenile ones within a species, and that as these sharks grow they tend to loose cusplets and even cusps on some replacement teeth and gradually become spotted with black (some adults may retain a plain coloration).

Triakis scyllium Müller & Henle, 1839

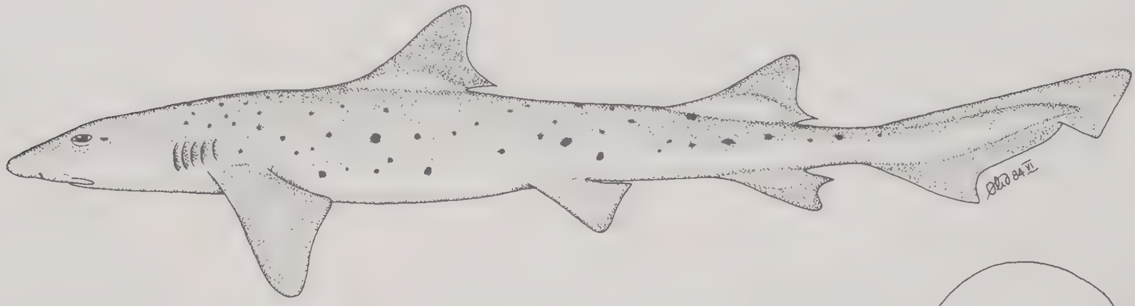
TRIAK Triak 4

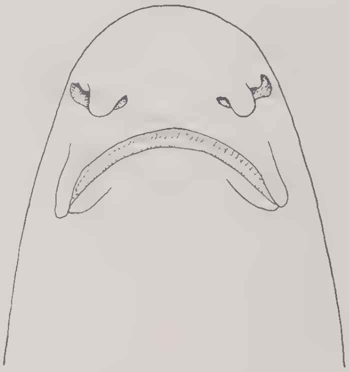
Triakis scyllium Müller & Henle, 1839, Syst.Beschr.Plagiost., pt. 2:63, pl. 26. Holotype: Rijksmuseum van Natuurlijke Historie, Leiden, dried specimen ? Type Locality: Japan.

Synonymy : Hemigaleus pingi Evermann & Shaw, 1927.

Other Scientific Names Recently in Use : Triakis scyllia Müller & Henle, 1839 (unnecessary emendation by Bigelow & Schroeder, 1948).

FAO Names : En - Banded houndshark; Fr - Virli coro; Sp - Tollo rayado.





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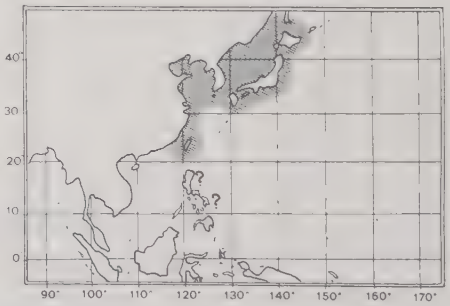
Field Marks : A moderately slender houndshark with a short broadly rounded snout, lobate anterior nasal flaps that do not reach the mouth and are far separated from each other, long upper labial furrows that reach the lower symphysis of the mouth, teeth partially bladelike, with strong, erect to oblique cusps on all teeth and well-developed cusplets, relatively narrow fins, and scattered black spots.

Diagnostic Features : Teeth with strong cusps and cusplets on almost all teeth, not semimolariform, lateroposterior teeth bladelike, with strongly oblique cusps. Pectoral fins broadly triangular in adults. First dorsal fin with nearly vertical or posteroventrally sloping posterior margin. Total vertebral counts 149 to 155. Body with sparsely scattered small black spots and broad dusky saddles in young, spots fading and sometimes absent in adults.



Geographical Distribution : Western North Pacific: Southern Siberia, Japan, the Koreas, China (including Taiwan Island), ? The Philippines.

Habitat and Biology : A common to abundant, temperate bottom-dwelling shark of the continental and insular shelves of the Western Pacific, often occurring in shallow water close inshore, on or near the bottom. Favours estuaries and shallow bays, especially sandy and algal-covered areas and eelgrass flats; apparently tolerant of reduced salinities. Seldom gregarious, though some may cluster in resting areas on bottom.

Ovoviviparous, without a yolk-sac placenta; number of young 10 to 20 per litter.

Feeds on small fishes and probably crustaceans and other bottom invertebrates.

Size : Maximum size at least 150 cm, males maturing between 99 and 108 cm.

Interest to Fisheries : Apparently commonly fished off Japan and probably the Koreas and northern China. Details are not known by the writer but its meat is apparently regarded as of inferior quality to other houndsharks in Japan.

Literature : Fowler (1941); Okada (1955); Lindberg & Legeza (1959); Compagno (1970, 1979); Masuda, Araga & Yoshino (1975).

Remarks : Synonymy of Hemigaleus pingi with this species follows Compagno (1979). Philippines records for this shark are doubtful. Four late fetal specimens in the Stanford University Fish Collection from the Philippines identified as T. scyllium by A.W. Herre, their collector, turned out to be an undescribed species of Hemitriakis (see Compagno, 1970, 1979).

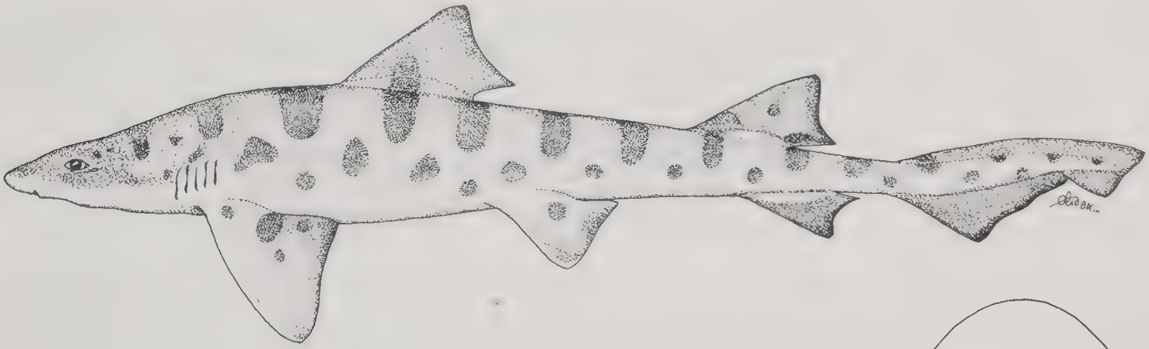
Triakis semifasciata Girard, 1854

TRIAK Triak 5

Triakis semifasciatum Girard, 1854, Proc.Acad.Nat.Sci.Philad., 7(6):196. Holotype: ? Type Locality: San Francisco, California, USA, near Presidio, San Francisco Bay.

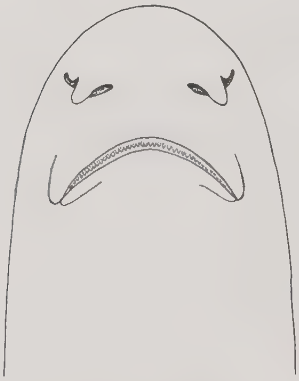
Synonymy : Triakis californicus Gray, 1851 (nomen nudum); Mustelus felis Ayres, 1854 (see remarks below).

FAO Names : En - Leopard shark; Fr - Virli léopard; Sp - Tollo leopardo.



Field Marks : The bold, saddled black colour pattern of this shark is unique.

Diagnostic Features : Strong cusps and cusplets on almost all teeth, teeth not semimolariform, lateroposterior ones bladelike, with strongly oblique cusps. First dorsal fin with posteroventrally sloping posterior margin; pectoral fins broadly triangular in adults. Total vertebral counts 129 to 150. Colour grey or bronzy-grey above, white below, with bold, large, broad black saddle-marks, becoming light-centred in adults, and scattered large black spots.



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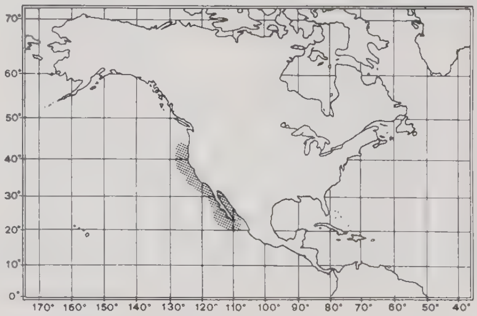
Geographical Distribution : Eastern North Pacific: from Oregon to Gulf of California, USA, and Mexico.



Habitat and Biology : An abundant, cool to warm-temperate shark of inshore and offshore continental littoral waters, most common on or near the bottom in shallow water from the intertidal to 4 m depth, less common down to 91 m. The leopard shark is commonly found in shallow, enclosed, muddy bays, often entering them as the tide rises and departing when it retreats. It favours flat sandy areas, mud flats, and bottoms strewn with rocks near rocky reefs and kelp beds. This is an active, strong-swimming shark, usually seen in undulating motion, that forms large schools sometimes mixed with grey or brown smooth-hound sharks (Mustelus californicus and M. henlei) and piked dogfish (Squalus acanthias). Movements are not well understood, and schools are apparently nomadic; they have been seen to appear in an area for a few hours and then disappear. In a tag-recapture ageing study initiated in 1979 with over 1100 leopard sharks tagged in San Francisco Bay off south San Francisco, Susan E. Smith of the U.S. National Marine Fisheries Service Tiburon Laboratory found that most of the sharks recaptured to date were recovered close to their tagging place, suggesting limited local movements; but that some managed to travel outside the Bay south about 150 km (S. Smith, pers. comm.). Leopard sharks are sometimes seen resting on the bottom by divers, on sand among rocks; and readily do so in aquaria.

This shark readily adapts to captivity, and can live over twenty years if captured when young. In captivity, it shows a strong preference for the bottom, although individuals will swim at midwater or at the surface. It is extremely hardy, and is one of the best sharks to keep in aquaria.

Ovoviviparous, without a yolk-sac placenta; number of young 4 to 29 per litter. S. Smith (pers. comm.), using sectioning technique to demonstrate the growth rings in the vertebrae of leopard sharks and tetracycline to calibrate the rings in sharks recaptured after being tagged, has found that these sharks are slow-growing, and as in the piked dogfish (Squalus acanthias) may take over a decade to mature.

The leopard shark is primarily an opportunistic feeder on bottom-dwelling animals with some littoral prey taken also; invertebrates are somewhat more important in its diet than fish prey. Items taken include cancrid, grapsid, and mole crabs; shrimp and ghost shrimp; clam siphons and sometimes feet and whole clam bodies; polychaete worms; a large, sausage-shaped echiuroid worm, the fat innkeeper or weenie worm (Urechis caupo), which can be the most frequent prey item in some localities; octopi; bony fishes, including anchovies, herring, topsmelt, croakers, surf perch, gobies, rockfish, sculpins, flounders, sanddabs, tongue-soles, and midshipmen (Porichthys); and small elasmobranchs, including brown smooth-hounds (Mustelus henlei), guitarfish (Rhinobatos productus), and bat rays (Myliobatis californicus). When available, the eggs of herring, topsmelt, jacksmelt, and midshipmen are avidly eaten by this shark. Crabs, shrimps, bony fish, fish eggs, clam necks and innkeeper worms are the most important prey items of leopard sharks.

There is considerable variation in the diet of the leopard shark with size and season in Elkhorn Slough, California (Talent, 1976). Juveniles below 70 cm feed mostly on crustaceans, primarily small crabs (especially grapsids), but as the sharks approach maturity other prey items increase in importance as crustaceans diminish. Fish are most heavily taken by adults over 130 cm, clam necks and fish eggs are most important to adults 110 to 130 cm, and innkeeper worms are most important to juveniles and adults 80 to 130 cm long. Young sharks feed heavily on grapsid crabs but prey more on larger cancrid crabs as they approach maturity. Small sharks feed mostly on crabs throughout the year while larger sharks show seasonal variation, primarily associated with the availability of fish eggs. Large sharks eat fish mostly during the summer, and fish eggs in winter through early summer when topsmelt, jacksmelt and herring spawn. Clams and crabs were most commonly taken in the autumn, with a shift in importance from grapsid to cancrid crabs and to innkeeper worms during winter and spring.

The common presence of mud-burrowing prey such as ghost shrimps, innkeeper worms, polychaetes, and clams (necks) suggest that these sharks actively feed very close to the mud or in it to a far greater extent that the sympatric brown smooth-hound (Mustelus henlei), which normally does not take clam siphons, rarely takes innkeeper worms, and captures polychaetes far less frequently than leopard sharks. The action of leopard sharks in taking clam siphons has not been seen, but although the clams protrude their siphons some distance from the mud, they are instantly retracted when disturbed, suggesting that the sharks must quickly seize and pull on them until the siphons break or are bitten off by their rather powerful jaws and small but sharp slicing teeth. Sometimes whole clam bodies are found as stomach contents, without shells; the shell removal method is not known, but one possibility is that the shark rips the clams free from their shells while tugging on their siphons, while another is that the shark violently shakes or rubs the shells off after extracting clams from the mud. Innkeeper worms do not leave their burrows but may protrude their bodies slightly, allowing the sharks to pull them out, but more likely the sharks are able to suck them out of their burrows since most of the worms are intact and without bite damage as stomach contents (Russo (1975); Talent (1976)).

Leopard sharks and piked dogfish have been observed catching anchovies together at the surface inside a hollow bridge support structure in San Francisco Bay, slowly swimming counterclockwise into oncoming clockwise-moving, densely packed schools of anchovies with their mouths wide open (Russo, 1975). The sharks did not show any specific hunting behaviour or directed movements toward their prey but simply ingested any anchovies that blundered into their mouths! See the account of the oceanic whitetip shark, Carcharhinus longimanus, for a similar observation with this species.

Eelgrass (Zostera) and marine algae have been found in the stomachs of several leopard sharks, probably taken incidentally by the sharks having fed on prey animals and fish eggs.

This shark was once recorded as harassing a diver with a nosebleed, but in general it is very wary and usually flees when approached underwater. It is generally regarded as harmless to people.

Size : Maximum 180 cm, males maturing between 70 and 119 cm and reaching 150 cm, females maturing between 110 and 129 cm and reaching 180 cm, though most adults are smaller than 160 cm; size at birth about 20 cm.

Interest to Fisheries : In California this species is commonly taken by sports anglers and spearfishers, but in recent years has come to be increasingly taken by smallscale commercial line fisheries. In some areas of California it may be declining in numbers, due to increased pressure by spear and line-fishers. Mexican catches are little-known, but presumably occur. Its meat is excellent and is utilized fresh or fresh-frozen for human consumption.

Literature : Roedel & Ripley (1950); Herald & Ripley (1951); Feder, Turner & Limbaugh (1974); Russo (1975); de Wit (1975); Talent (1976); Susan E. Smith (pers. comm.); L.J.V. Compagno (unpub. data).

Remarks : The earliest name for this species is Triakis californica Gray, 1851, proposed without description and hence a nomen nudum unless the name of the species itself is considered a valid indication of its identity (that is, a member of the hitherto monotypic genus Triakis from California). The writer examined the five syntypes of Triakis californica, British Museum (Natural History) BMNH 1953.5.10.8-12 late fetuses, 160 to 173 mm long, from Monterey, California) and confirmed that they are indeed conspecific with T. semifasciata. However, even if T. californica is a valid name, it would not serve nomenclatural stability to replace the well-known and virtually universally used T. semifasciata.

Triakis felis Ayres, 1854 was published about one month (4 December 1854) later than T. semifasciatum Girard, 1854 (November, 1854, possibly on 14 November; Lillian P. Dempster, pers. comm.).

9.6 FAMILY HEMIGALEIDAE Hasse, 1879

Family Hemigalei or Hemigaleus Hasse, 1879, Natürl.Syst.Elasmobranch., pt. 1:4, 53.

Synonymy : Subfamily Hemipristinae Fowler, 1941 (Family Galeorhinidae).

FAO Names : En - Weasel sharks; Fr - Milandres; Sp - Tiburones comadreja.

Field Marks : Small to moderate-sized sharks with horizontally oval eyes, internal nictitating eyelids, no nasoral grooves or barbels, small spiracles, a short to long, arched mouth that reaches past anterior ends of eyes, moderately long labial furrows, small to moderately large bladelike teeth in the upper jaw, more or less cuspidate teeth in the lower jaw, two moderate-sized spineless dorsal fins and an anal fin, the first dorsal base well ahead of pelvic bases, the second dorsal fin about 2/3 as large as first, precaudal pits present, caudal fin with a strong ventral lobe and lateral undulations on its dorsal margin, intestine with a spiral valve, and usually no colour pattern.

Diagnostic Features : Head without laterally expanded blades; eyes horizontally oval, with lengths 1.1 to 1.9 times the height; nictitating eyelids internal; spiracles present and small anterior nasal flaps lobular and short, not barbel-like; internarial width about 1.9 to 3 times the nostril width; labial furrows moderately long; teeth small to large, with acute and narrow to moderately broad cusps, lateral cusplets; basal ledges and grooves strong to vestigial; teeth strongly differentiated in upper and lower jaws, uppers compressed and bladelike, lowers cuspidate and not compressed; posterior teeth not comblike; tooth rows 25 to 36/28 to 43. Precaudal pits present. First dorsal fin moderately large and not keel-like, much shorter than caudal fin; first dorsal base well ahead of pelvic bases, equidistant between pectoral and pelvic bases or slightly closer to pectoral bases than to pelvics; midpoint of first dorsal base always in front of pelvic origins; pectoral fins with radials extending into distal web of fins. Ventral caudal lobe strong, undulations or ripples present in dorsal caudal margin. Neurocranium without supraorbital crests; vertebral centra with strong, wedge-shaped intermedial calcifications. Valvular intestine with a spiral valve of 4 to 6 turns. Colour usually uniform greyish, sometimes with horizontal stripes. Development viviparous.

Habitat, Distribution and Biology : The Hemigaleidae is a small family of common coastal tropical sharks of continental and insular shelf waters down to 100 m depth but usually in shoaler water. Although formerly of worldwide distribution, they currently are limited to the eastern Atlantic and continental Indo-West Pacific but not extending far into the central Pacific. Most of the approximately 7 species are small, and attain a length of 1.4 m or less, but the snaggletooth shark (Hemipristis elongatus) reaches about 2.3 to 2.4 m. The family is closely related to, and is a sister family of the Carcharhinidae, but is readily distinguishable.

Hemigaleids feed on a variety of small bony fishes, small elasmobranchs, cephalopods, crustaceans, and echinoderms. At least two species of small weasel sharks (Paragaleus pectoralis and Hemigaleus microstoma) specialize on a largely cephalopod diet and have small, short mouths, rather weak flat jaws, small upper cutting teeth and small erect lower teeth; while the largely fish-eating Hemipristis elongatus has a long mouth, powerful jaws, large, serrated upper teeth and long curved lower teeth. These structural differences may reflect differences in feeding behaviour between the cephalopod specialists and fish-eaters of this family. The shortened mouths of the cephalopod feeders could enhance suction feeding at the expense of grabbing and impaling ability, which may be more effective against squid, cuttlefish and octopi; the rather small teeth of the cephalopod specialists may be adequate for holding and dismembering such soft, slippery prey. Conversely, the elongated mouth and impressive, rather mako-like teeth of the snaggletooth shark (and possibly also the hooktooth shark, Chaenogaleus macrostoma, with similar jaws and teeth) may be more effective against fish victims, in grabbing, impaling and slicing them after a chase. The snaggletooth shark (and the hooktooth) has much larger gill slits than the two known cephalopod specialists, and may be a more active swimmer; the short gill slits of the cephalopod eaters may be helpful in limiting backflow into the pharynx during suction feeding.

These sharks are not known to have attacked people, and for the most part are probably harmless; however, the snaggletooth shark is sufficiently large and powerfully armed to be considered at least potentially dangerous.

Interest to Fisheries : Members of this family are common catches in artisanal and small commercial inshore and near offshore fisheries where they occur, in the eastern Atlantic and Indo-West Pacific. They are utilized primarily for human consumption, but fins of the larger species may be used by the oriental sharkfin trade and liver oil for vitamins. They are however, of modest importance in such fisheries, as they are greatly outnumbered by various species of the Carcharhinidae and Sphyrnidae where they occur.

Remarks : The present arrangement of the Hemigaleidae follows Compagno (1979). Genera in this family have conventionally been placed in the Carcharhinidae.

Key to Genera :

1a. Lower anterolateral teeth with long, hooked cusps that prominently protrude from the mouth. Gill slits long, longest 1.8 to 3 x eye length in adults (Fig. 1)

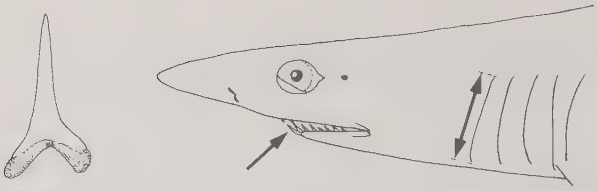
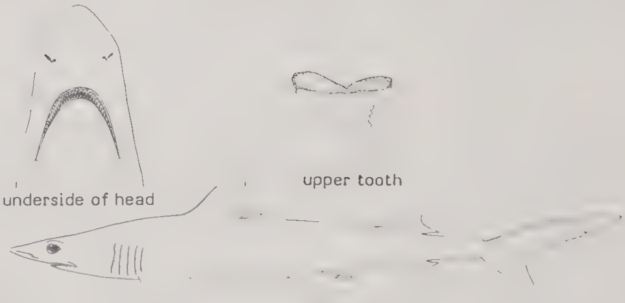


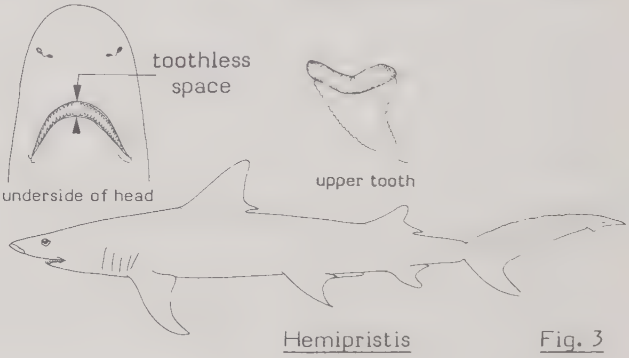
Fig. 1

2a. Snout obtusely wedge-shaped in dorsoventral view. Lower jaw rounded at symphysis. No toothless space at midline of jaws. Mesial edges of teeth unserrated, sometimes a few cusplets on mesial edges of lower teeth. Fins not falcate, posterior margins of anal and second dorsal moderately concave, those of pectorals and pelvics straight or slightly concave (Fig. 2) .... **Chaenogaleus**



Chaenogaleus Fig. 2

2b. Snout bluntly rounded in dorsoventral view. Lower jaw truncated at symphysis. A toothless space between teeth at midline of both jaws. Mesial edges of upper teeth and most lowers serrated or with a few cusplets (except for young below 55 cm, in which they are smooth). Fins strongly falcate, posterior margins of anal, second dorsal, pectoral and pelvic fins deeply concave (Fig. 3) .... **Hemipristis**



Hemipristis Fig. 3

1b. Lower anterolateral teeth with short, straight or weakly hooked cusps that are concealed in the mouth or protrude slightly from it. Gill slits short, longest 1.1 to 1.3 x eye length in adults (Fig. 4)

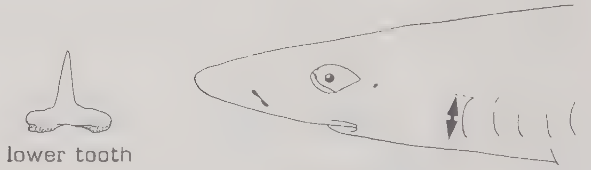
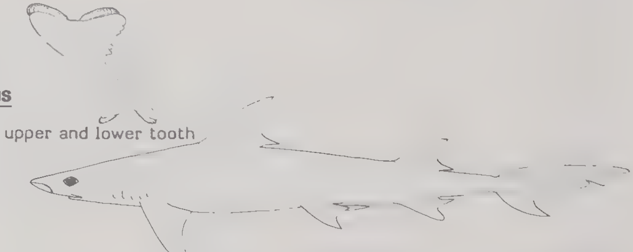


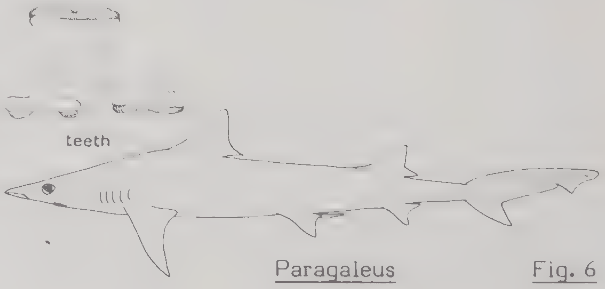
Fig. 4

3a. Upper anterolateral teeth with very short cusps. No cusplets on lower teeth, roots and crown feet deeply arched, giving teeth an inverted Y shape. Tooth row counts 25 to 34/37 to 43, 6 to 20 more lower rows than uppers. Pelvic and dorsal fins, and ventral caudal lobe strongly falcate (Fig. 5) .... **Hemigaleus**



Hemigaleus Fig. 5

3b. Upper anterolateral teeth with long cusps. Distal and sometimes mesial cusplets present on some lower anterolateral teeth, roots and crown feet hardly arched, giving teeth an inverted T shape. Tooth row counts 26 to 30/27 to 33, with 1 less to 5 more lower rows than uppers. Pelvic and dorsal fins, and ventral caudal lobe not falcate (Fig. 6) .... **Paragaleus**



Paragaleus Fig. 6

Chaenogaleus Gill, 1862

HEMIG Chaen

Genus : Chaenogaleus Gill, 1862, Ann.Lyceum Nat.Hist.N.Y., 7:402.

Type Species : "Chaenogaleus macrostoma Gill", by original designation, equals Hemigaleus macrostoma Bleeker, 1852.

Synonymy : None.

Diagnostic Features : Snout wedge-shaped in dorsoventral view; gill slits very long, 1.8 to 2.1 times the eye length in adults; mouth parabolic and very long, its length 66 to 82% of its width; lower jaw rounded at symphysis; ends of upper labial furrows behind rear corners of eyes; no toothless space at midlines of jaws; upper anterolateral teeth with smooth mesial edges and very long cusps; lower anterolateral teeth with very long, stout, strongly hooked cusps, and no cusplets; lower crown feet and roots deeply arched, giving teeth an inverted Y shape; lower teeth protrude prominently when mouth is closed; tooth row counts 33 to 38/34 to 36, with 2 more lower rows to 2 less than upper rows. Fins not falcate; second dorsal height 3/5 or more of first dorsal height.

Remarks : See Compagno (1979) for the rationale for separating this genus from Hemigaleus, with which it is usually synonymized.

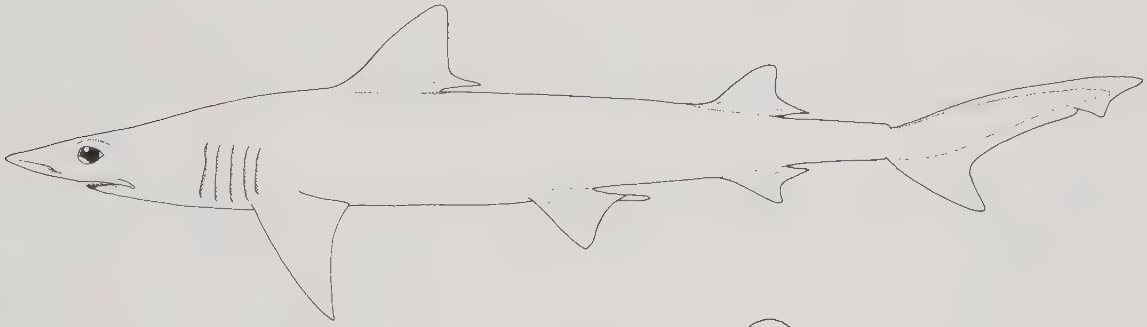
Chaenogaleus macrostoma (Bleeker, 1852)

HEMIG Chaen 1

Hemigaleus macrostoma Bleeker, 1852, Verh.Batav.Genoot.Kunst.Wet., 24:46, pl. 2, fig. 10. Holotype: One specimen mentioned in Bleeker's original account, a male stated to be 690 mm long, is apparently in the British Museum (Natural History), BMNH 1867.11.28.197, 699 mm long as measured by the writer (Dr M. Boeseman, pers.comm., 1981). Type Locality: Java.

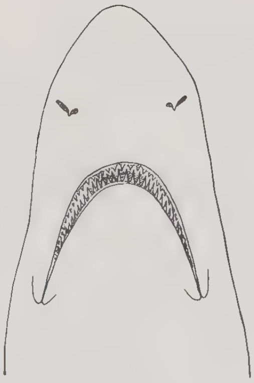
Synonymy : Hemigaleus balfouri Day, 1878.

FAO Names : En - Hooktooth shark; Fr - Milandre harpon; Sp - Comadreja ganchuda.



Field Marks : A small, slender shark with an angular, moderately long snout, large lateral eyes with nictitating eyelids, small spiracles, long gill slits about twice eye length or more, very long parabolic mouth with prominently protruding lower teeth, upper teeth with distal cusplets but no serrations, lower teeth with extremely long, hooked smooth-edged cusps, two spineless dorsal fins and an anal fin, second dorsal about 2/3 the size of first, second dorsal origin opposite or slightly ahead of anal origin, anal fin smaller than second dorsal and without preanal ridges, transverse, crescentic precaudal pits, and light grey or bronze colour with no prominent markings.

Diagnostic Features : See genus.



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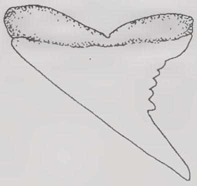
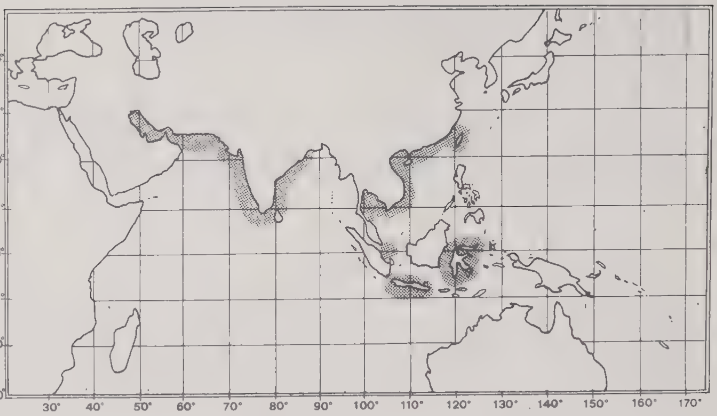


upper tooth

Geographical Distribution : Indo-West Pacific: The "Gulf", Pakistan, India, Sri Lanka, Singapore, Thailand, Viet Nam, China (including Taiwan Province), Java, Sulawesi.

Habitat and Biology : A common inshore tropical shark of the continental and insular shelves, caught at depths down to 59 m. Development viviparous, with a yolk-sac placenta; number of young 4 per litter. Diet unrecorded, but probably eats small fishes, cephalopods, and crustaceans.

Size : Maximum about 100 cm, adult males 68 to 97 cm. Size at birth at least 20 cm.



Interest to Fisheries : Commonly caught in inshore and offshore artisanal fisheries off Pakistan, India, Sri Lanka, and probably elsewhere in its range. Caught in drifting and bottom gillnets and on longlines and other line gear. Meat utilized fresh for human consumption; offal processed into fishmeal.

Literature : Fowler, (1941); Setna & Sarangdhar (1949c); Chen (1963); Misra (1969); Compagno (1979).

Remarks : Hemigaleus balfouri is apparently a synonym of this species, judging from its original description (Day, 1878); unfortunately its holotype is lost. Apparently this name has been used indiscriminately for the three species of hemigaleids in Indo-Pakistani waters other than Hemipristis elongatus. See Compagno (1979) for a discussion of this problem.

Hemigaleus Bleeker, 1852

HEMIG Hemig

Genus : Hemigaleus Bleeker, 1852, Verh.Batav.Genoot.Kunst.Wet., 24:45.

Type Species : Hemigaleus microstoma Bleeker, 1852, by subsequent designation of Gill (1862:402).

Synonymy : Genus Negogaleus Whitley, 1931.

Diagnostic Features : Snout rounded in dorsoventral view; gill slits short, 0.8 to 1.3 times eye length in adults; mouth broadly arched and very short, its length 31 to 43% of its width; lower jaw rounded at symphysis; ends of upper labial furrows extend in front of rear corners of eyes; no toothless space at midlines of jaws; upper anterolateral teeth with smooth mesial edges and very short cusps; lower anterolateral teeth with short, slender, unhooked cusps, and no cusplets; lower crown feet and roots deeply arched, giving teeth an inverted Y shape; lower teeth not protruding when mouth is closed; tooth row counts 25 to 34/37 to 43, 6 to 20 more lower rows than uppers; dorsal and pelvic fins and ventral caudal lobe strongly falcate; second dorsal height 3/5 or more of first dorsal height.

Remarks : Whitley (1931:334) proposed Negogaleus as a replacement name for Hemigaleus, on the erroneous assumption that Hemigaleus is a junior homonym of Hemigalea Blainville, 1837 and Hemigalus Jourdain, 1837 in mammals (Viverridae), but under the present International Code of Zoological Nomenclature Hemigaleus is valid (Compagno, 1979).

Hemigaleus and its synonym Negogaleus have at one time or another included a total of nine species (balfouri, brachygnathus, longicaudatus, machlani, macrostoma, microstoma, pectoralis, pingi, and tengi). Under the revision by Compagno (1979), three of these fall in Paragaleus (longicaudatus, pectoralis and tengi), two (balfouri and macrostoma) in Chaenogaleus, one (pingi) in Triakis (as a synonym of T. scyllium), leaving three in Hemigaleus: H. brachygnathus Chu, 1960, H. machlani Herre, 1929, and H. microstoma Bleeker, 1852.

The account of the Chinese H. brachygnathus by Chu et al. (1963) and Bessednov (1964), when compared with specimens and data of Hemigaleus microstoma from Java, Singapore, and Thailand (including the surviving syntype), strongly suggests that Chu's species is a synonym of H. microstoma (see also Compagno , 1979). It is difficult to determine if H. machlani is a valid species from its brief, unillustrated account (the holotype if unfortunately lost; J.A.F. Garrick, pers. comm.), but dentitional characters and its falcate pectoral fins and white-tipped dorsal fins suggest that the species was based on H. microstoma. However, no Philippine specimens of Hemigaleus or hemigaleids were available for examination.

Only one species is currently recognized in the genus Hemigaleus, H. microstoma. However, Stevens & Cuthbert (1983) noted that the Australian representative of this species, termed Negogaleus microstoma by Whitley (1939, 1940) and subsequent writers (surprisingly, Whitley did not propose a new name for this shark), differs consistantly in vertebral counts, coloration (with black dorsal fin tips instead of white ones), and tooth counts from typical *H. microstoma* as described by Compagno (1979). In addition, Compagno (1979) noted that Indian and Sri Lankan *H. microstoma* examined by him differ from typical members of the species in having somewhat higher vertebral counts. Whether these differences represent populational differences within a species or indicate that more than one species of *Hemigaleus* is involved remains to be seen. What is necessary is adequate collections of *Hemigaleus* from almost all the areas where these sharks occur, and sampling in little-known areas of the Indo-West Pacific to determine if they occur there.

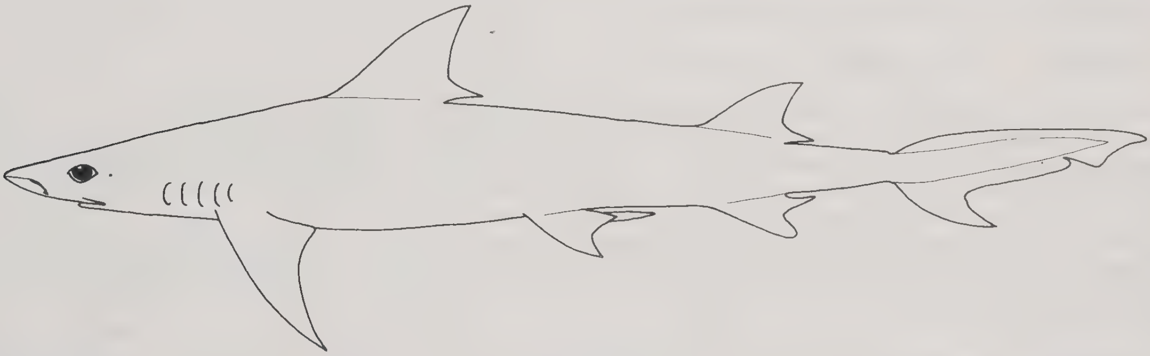
Hemigaleus microstoma Bleeker, 1852

HEMIG Hemig 1

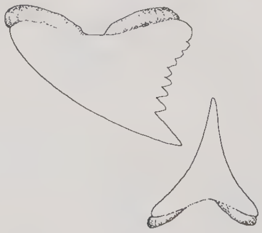
Hemigaleus microstoma Bleeker, 1852, *Verh.Batav.Genoot.Kunst.Wet.*, 24:46, pl. 2, fig. 9. Syntypes: Two specimens, 625 and 701 mm females, are mentioned in Bleeker's (1852) original description. One of these is a specimen in the British Museum (Natural History), BMNH 1867.11.28.173, 703 mm female, but the other may be lost (Dr M. Boeseman, pers. comm.). Type Locality: Batavia (Djakarta), Java.

Synonymy : ? *Hemigaleus machlani* Herre, 1929; ? *Negogaleus brachygnathus* Chu, 1960.

FAO Names : En - Sicklefin weasel shark; Fr - Milandre faucille; Sp - Comadreja segadora.



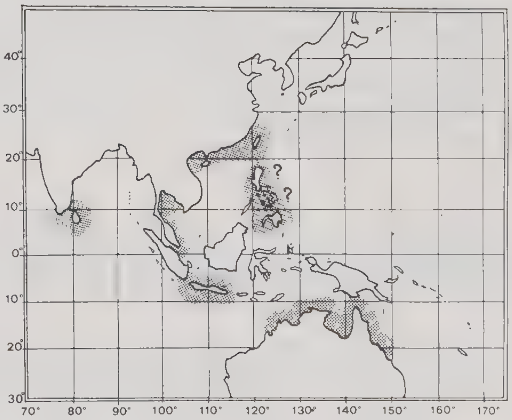
Field Marks : A small slender shark with a rounded, moderately long snout, large lateral eyes with nictitating eyelids, small spiracles, short gill slits about 1.3 times eye length in adults (less in young), very short, small arched mouth with teeth not protruding, upper teeth with distal cusplets but no serrations, lower teeth shaped like inverted Ys, with short, straight, smooth-edged cusps, no cusplets, and highly arched roots, highly falcate fins, including two spineless dorsal fins and an anal fin, second dorsal about 2/3 size of first, second dorsal origin slightly ahead of anal origin, anal fin smaller than second dorsal and without preanal ridges, transverse, crescentic precaudal pits, and light grey or bronze colour with no prominent markings other than white or black fin tips and sometimes white spots on sides.



upper and lower tooth

Diagnostic Features : See genus.

Geographical Distribution : Indo-West Pacific: Southern India, Sri Lanka, Thailand, Singapore, Java, China (including Taiwan Island), the Philippines, Australia (Queensland, northern and Western Australia).



Habitat and Biology : This is a small, relatively common inshore species of tropical continental seas. In Australian waters the sicklefin weasel shark has been taken at depths of 12 to 167 m on the continental shelf on or near the bottom (bottom temperature 22^{0} to 27.6^{0}C).

Viviparous, with a yolk-sac placenta; litters from the Australian representative of the species range from 4 to 14 fetuses. Full-term fetuses with detached umbilical cords and placentae are 23.7 to 25.6 mm.

The sicklefin weasel shark is a specialist feeder on cephalopods, eating mostly octopi, cuttlefish, and squid, but also crustaceans and echinoderms.

Size : Maximum at least 91 cm, in non-Australian sharks, with mature males from 72 to 91 cm, and adult females 85 cm. In the Australian representative of the species males mature at about 60 cm and reach 94 cm; females are adolescent or subadult and possibly sexually active between 45 and 60 cm while pregnant females are as small as 68 cm, with all females above 75 cm and up to 97.2 cm being pregnant or spent. Size at birth about 26 to 28 cm. A length-weight power curve for the Australian representatives of this species (Stevens & Cuthbert, 1983) is:

$$WT = 2.647 \times 10^{-3} TL^{3.07}.$$

Interest to Fisheries : Taken regularly in inshore artisanal fisheries in the Indo-Pacific, but apparently not extremely abundant. Caught in gillnets and probably on line gear; meat utilized for human consumption.

Literature : Chen (1963); Chu et al. (1963); Compagno (1979); Stevens & Cuthbert (1983).

Hemipristis Agassiz, 1843

HEMIG Hemip

Genus : Hemipristis Agassiz, 1843, Rech.Poiss.Foss., 3:237.

Type Species : Hemipristis serra Agassiz, 1843, by subsequent designation of Woodward (1889:450).

Synonymy : Genus Dirrhizodon Kunzinger, 1871; Genus Heterogaleus Gohar & Mazhar, 1964.

Diagnostic Features : Snout broadly rounded in dorsoventral view; gill slits very long, 3 to 3.5 times the eye length in adults; mouth trapezoidal-parabolic and long, length 50 to 70% of its width; lower jaw truncated at symphysis; ends of upper labial furrows behind rear corners of eyes; a toothless space at midlines of both jaws; upper anterolateral teeth with serrated (smooth in young) mesial edges and short cusps; lower anterolateral teeth with very long, stout, strongly hooked cusps, and serrations and cusplets variably developed on the crown feet; lower crown feet and roots deeply arched, giving teeth an inverted Y shape; lower teeth protrude prominently when mouth is closed; tooth row counts 26 to 30/30 to 36, with 4 to 9 more lower rows than uppers. Fins strongly falcate, posterior margins of anal, second drosal, pectoral and pelvic fins deeply concave; second dorsal height 2/5 to slightly less than 3/5 of first dorsal height.

Remarks : The genera Dirrhizodon and Heterogaleus are considered junior synonyms of Hemipristis (see Bass, D'Aubrey & Kistnasamy, 1975, Compagno, 1979), which has as its type the fossil H. serra. Fossil Hemipristis species were distributed worldwide in the Tertiary, but the living species is confined to the Indian and western Pacific Oceans. Some of the fossils apparently attained a larger size than the living H. elongatus, between 3 and 5 m.

Compagno (1973d) distinguished the living species as a separate genus, Dirrhizodon, by virtue of tooth histological differences from fossil Hemipristis he had examined, but later (Compagno, 1979) reunited these genera because these differences did not hold.

Apart from a number of fossils, there have been four nominal species of living sharks that fall in this genus, all of which are probably synonyms of H. elongatus (Klunzinger, 1871). In the case of Carcharias ellioti Day, 1878, the issue was confused by the juxtaposition of figure titles of this species with Carcharias acutidens (= Negaprion acutidens), but the description identifies the figure and both make the identity of this species clear. The same applies for Heterogaleus ghardaquensis Gohar & Mazhar, 1964 and Paragaleus acutiventralis Chu, 1960 (which is apparent from descriptions and figures of the former in Gohar & Mazhar, 1964, and the latter in Chu et al., 1964), while Hemipristis pingali Setna & Sarangdar (1946) was synonymized with H. elongatus by its describers (Setna & Sarangdhar, 1949b).

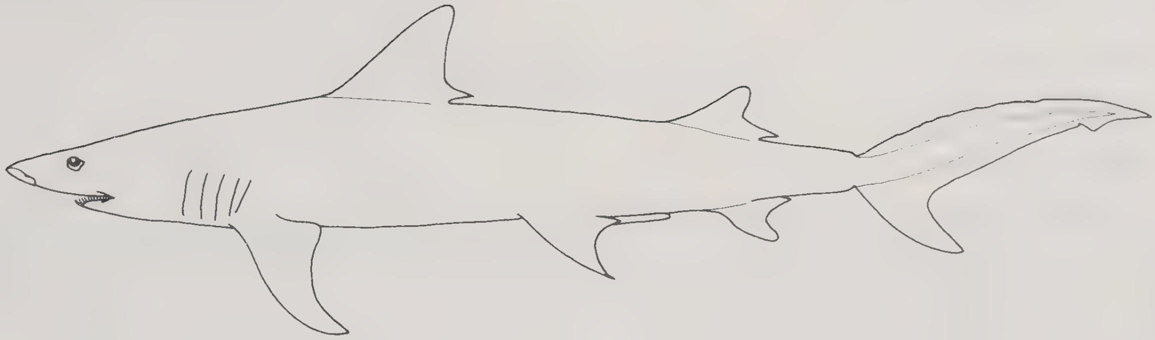
Hemipristis elongatus (Klunzinger, 1871)

HEMIG Hemip 1

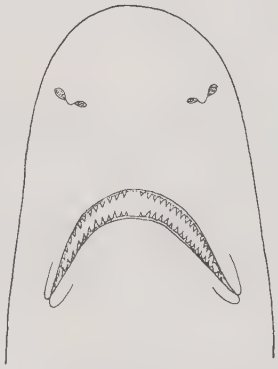
Dirrhizodon elongatus Klunzinger, 1871, Verh.K.K.Zool.-Bot.Ges.Wien, 21:665. Holotype: In Stuttgart Museum? Type Locality: Red Sea.

Synonymy : Carcharias ellioti Day, 1878; Hemipristis pingali Setna & Sarangdhar, 1946; Paragaleus acutiventralis Chu, 1960; Heterogaleus ghardaquensis Gohar & Mazhar, 1964.

FAO Names : En - Snaggletooth shark; Fr - Milandre chicor; Sp - Comadreja sobrediente.



Field Marks : A moderately large, fairly slender shark with a broadly rounded (in dorsoventral view), moderately long snout, large lateral eyes with nictitating eyelids, small spiracles, long gill slits about three times eye length or more, long trapezoidal-parabolic mouth with truncated lower symphysis and prominently protruding lower teeth, upper teeth with distal cusplets and mesial serrations, lower teeth with extremely long, hooked cusps and cusplets and serrations at their bases, two spineless dorsal fins and an anal fin, second dorsal about 2/3 size of first, second dorsal origin somewhat ahead of anal origin, anal fin smaller than second dorsal and without extended preanal ridges, transverse, crescentic precaudal pits, and light grey or bronze colour with no prominent markings.



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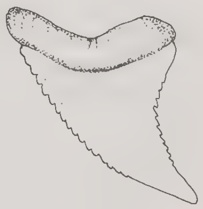
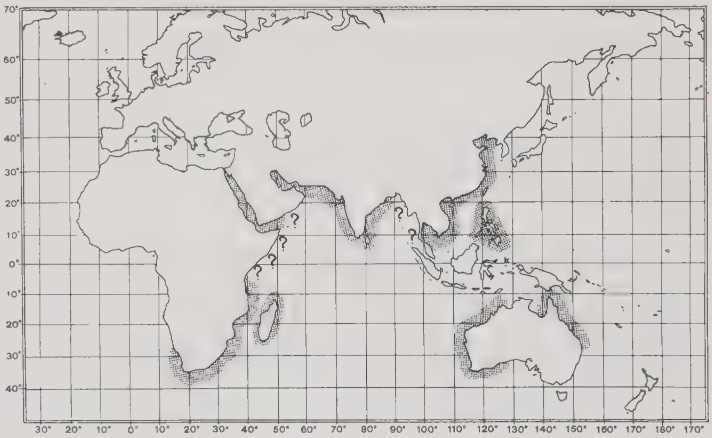


upper tooth

Diagnostic Features : See genus.

Geographical Distribution : Indo-West Pacific: South Africa, Madagascar, Mozambique, Tanzania, Aden, Red Sea, the "Gulf", Pakistan, India, Thailand, Viet Nam, China, Australia (Queensland, Western Australia), The Philippines.



Habitat and Biology : A rare to common tropical coastal shark, inshore and offshore on the continental and insular shelves at depths of 1 to 30 m.

Viviparous, with a yolk-sac placenta; 6 to 8 young per litter.

Eats a variety of fish prey, including anchovies, sea catfish, Bombay ducks (Harpadon), mackeral, croakers, grey sharks (Carcharhinus) and butterfly rays (Gymnura). Thought to be potentially dangerous because of its large, fearsome teeth and shallow-water habitat, but never recorded in an attack on people.

Size : Maximum from 230 to 240 cm; males adolescent at 73 to 106 cm and adult at 120 to 145 cm; females adult at 170 to 218 cm; size at birth about 45 cm.

Interest to Fisheries : Regularly taken in artisanal fisheries in the Indian Ocean and western Pacific (including the Red Sea), especially off Pakistan, India and Thailand. Caught with floating and fixed bottom gillnets, floating longlines, and probably on hook and line. Meat utilized fresh for human consumption, and in India considered one of the best sharks for food; liver processed for vitamins; fins used in the oriental sharkfin trade, and offal for fishmeal.

Literature : Setna & Sarangdhar (1946, 1949b); Smith (1957b); Fourmanoir (1961); Garrick & Schultz (1963); Gohar & Mazhar (1964); Fourmanoir & Nhu-Nhung (1965); Compagno (1970, 1979).

Paragaleus Budker, 1935

Genus : Paragaleus Budker, 1935, Bull.Mus.Natl.Hist.Nat., Paris, ser. 2, 7(2):107.

Type Species : Paragaleus gruveli Budker, 1935, by monotypy.

Synonymy : None.

Diagnostic Features : Snout rounded or slightly pointed in dorsoventral view; gill slits short, 1.1 to 1.3 times the eye length in adults; mouth broadly arched or parabolic and short to moderately long, its length 44 to 64% of its width; lower jaw rounded at symphysis; ends of upper labial furrows reach rear corners of eyes; no toothless space at midlines of jaws; upper anterolateral teeth with smooth mesial edges and moderately long cusps; lower anterolateral teeth with short, fairly stout, unhooked or slightly hooked cusps and distal and sometimes mesial cusplets; roots and crown feet hardly arched, giving teeth an inverted T shape; lower teeth not protruding or slightly protruding when mouth is closed; tooth row counts 26 to 30/27 to 33, with 1 less to 5 more lower rows than uppers. Dorsal and pelvic fins, and ventral caudal lobe not falcate; second dorsal height 3/5 or more of first dorsal height.

Remarks : The scope of this genus was expanded by Compagno (1979) beyond that of Bigelow & Schroeder (1948) to include an additional species, Negogaleus tengi Chen, 1963 (with N. longicaudatus Bessednov, 1964 as a synonym). In addition, there two undescribed species of Paragaleus in the western Indian Ocean, one in the "Gulf" and Persian Gulf and from Pakistan down to southern and eastern India and Sri Lanka, and a second from South Africa and possibly off Madagascar. Both differ from named species of Paragaleus in vertebral counts (97 to 108 precaudal and 170 to 186 total centra, versus 72 to 83 precaudal and 131 to 150 centra in P. pectoralis and P. tengi; see also Compagno, 1979). The South African species will be described by Dr Malcolm Smale and the writer, the northwestern Indian Ocean species by the writer.

Key to Species :

1a. Upper labial furrows reaching anteriorly nearly or quite to level of upper jaw symphyses. Cusps of lower lateral teeth mostly with oblique cusps .... **P. pectoralis**

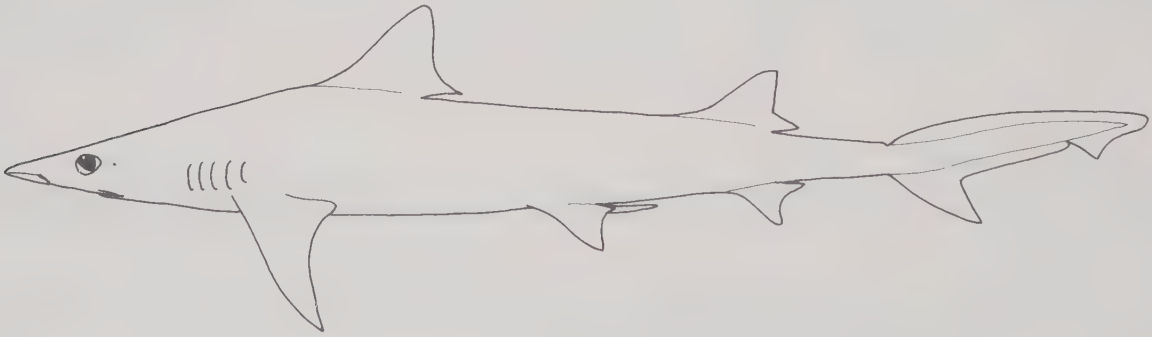
1b. Upper labial furrows falling well behind symphyses of jaws. Cusps of lower lateral teeth mostly with erect cusps .... **P. tengi**

Paragaleus pectoralis (Garman, 1906)

Hemigaleus pectoralis Garman, 1906, Bull.Mus.Comp.Zool.Harv.Coll., 46(11):203. Holotype: Museum of Comparative Zoology, Harvard University, MCZ-847, 651 mm female. Type Locality: "...from the 'Aquarial Gardens', for which the collections were made off the coasts of Massachusetts and Rhode Island." (Garman, 1906).

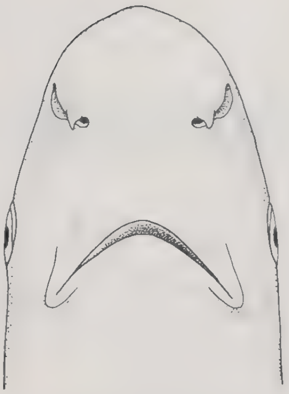
Synonymy : Paragaleus gruveli Budker, 1935.

FAO Names : En - Atlantic weasel shark; Fr - Milandre jaune; Sp - Tiburón comadiza.



Field Marks : A small slender shark with a rounded, moderately long snout, large lateral eyes with nictitating eyelids, small spiracles, moderate-sized gill slits about 1.3 times eye length in adults (less in young), rather short arched mouth with upper labial furrows reaching anteriorly to symphyses of jaws, lower teeth not prominently protruding, upper teeth with distal cusplets but no serrations, lower anterior teeth with moderately long, nearly straight smooth-edged cusps, lateral teeth with prominent cusplets and mostly oblique cusps, roots of lower teeth not strongly arched, anterior teeth T shaped, two spineless dorsal fins and an anal fin, second dorsal about 2/3 size of first, second dorsal origin slightly ahead of anal origin, anal fin smaller than second dorsal and without preanal ridges, transverse, crescentic precaudal pits, and light grey or bronze colour with longitudinal yellow bands on the body (not prominent in preserved specimens) and light posterior fin margins.

Diagnostic Features : Upper labial furrows reaching anteriorly to upper symphysis; lower anterior and lateral teeth with prominent cusplets present on distal and (especially in anterior teeth) mesial crown feet; lateral teeth with mostly oblique cusps. Caudal vertebral centra 62 to 73, total vertebral counts 135 to 149.



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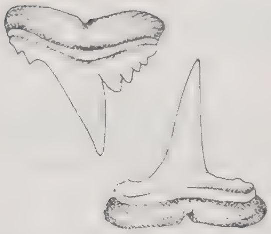
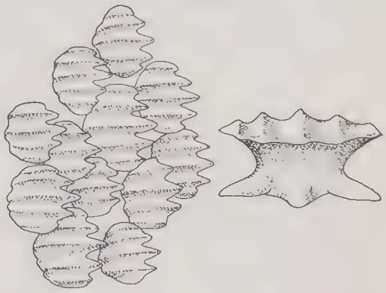
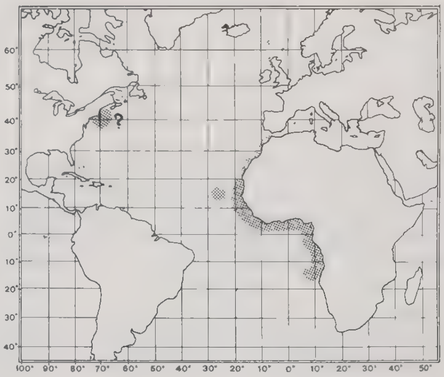


upper and lower tooth



dermal denticles

Geographical Distribution : Eastern Atlantic: Cape Verde Islands and Mauritania to Angola, possibly northward to Morocco. ?Western North Atlantic: New England (see remarks below).



Habitat and Biology : A very common inshore to offshore shark of the continental shelf of tropical and warm-temperate West and northwest Africa, inshore to offshore from a few metres to slightly over 100 m.

Viviparous, with a yolk-sac placenta; number of young per litter 1 to 4 but mostly (60% of 77 individuals) 2. Off Senegal most young are born in May and June.

As with *Hemigaleus microstoma* (or a close relative) off Australia, this species apparently is a specialist feeder that prefers cephalopods, including squid and octopi. Of a large number examined off Senegal 90% had cephalopods in their stomachs (Cadenat & Blache, 1982). The remainder of this species' diet is comprised of small bony fishes, including soles and sardines.

Size : Maximum 138 cm; males mature at about 80 cm, with adult males reported from 76 to 114 cm; females mature between 75 and 90 cm, with adult females reported from 83 to 117 cm; size at birth about 47 cm.

Interest to Fisheries : A common catch of artisanal and small commercial fisheries in the eastern Atlantic, but also taken by offshore international fisheries. It is caught on longlines, hook-and-line, gillnets, and bottom trawls; its meat is used fresh and dried salted for human consumption, and it is processed into fishmeal.

Literature : Cadenat (1950, 1957); Krefft (1968); Compagno (1979); Cadenat & Blache (1982).

Remarks : *P. gruveli* is considered a synonym of *P. pectoralis*, following Krefft (1968), Compagno (1979), and Cadenat & Blache (1982). The record of the holotype of this species from off New England may have been based on a waif that had crossed the Atlantic on the North Equatorial Current and rode the Gulf Stream up to where it was captured, since no further records of it have been reported from anywhere in the tropical western Atlantic. As probably suitable tropical habitat exists for this shark in the western Atlantic and such habitat has been extensively surveyed, the chances that a common, wide-ranging eastern Atlantic shark such as this species has an undiscovered cryptic population in the western Atlantic are limited. Another possibility is that the locality data for the specimen as obtained by Garman is erroneous. It seems unlikely that the shark was transported alive from the eastern Atlantic by human agency to the "Aquarial Gardens", because of the slow transportation (steamships) and limited aquarial technology available at the turn of the century.

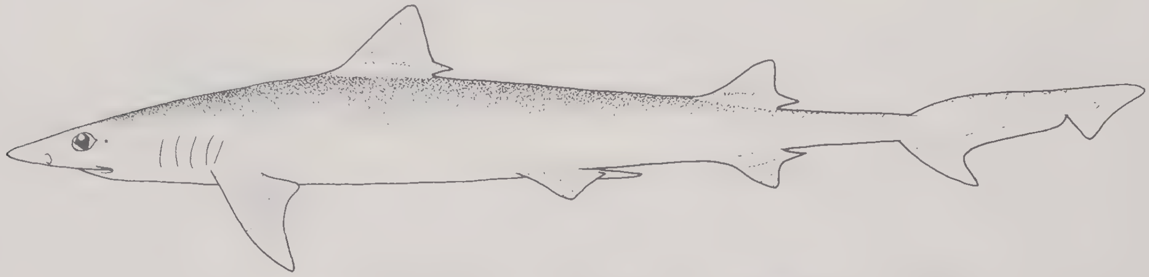
Paragaleus tengi (Chen, 1963)

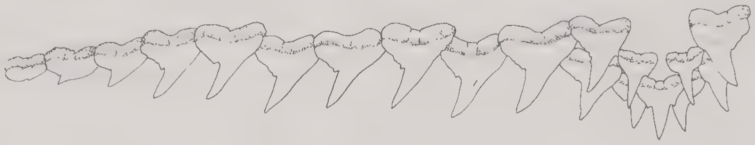
HEMIG Para 2

Negogaleus tengi Chen, 1963, Biol.Bull.Dep.Biol.Coll.Sci.Tunghai Univ.(Ichthyol.Ser. 1), (19):77, fig. 24. Syntypes: Tunghai University fish collection, Taiwan Island (Province of China), THUP 01802, 810 mm adult male, THUP 01803, 750 mm male, and THUP 01804, 770 mm male. Type Locality: Taichung Market, Taiwan, Province of China.

Synonymy : Negogaleus longicaudatus Bessednov, 1964.

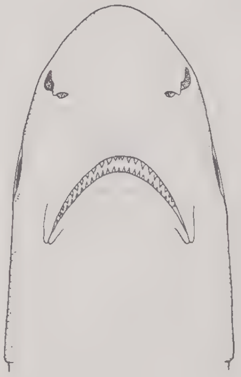
FAO Names : En - Straight-tooth weasel shark; Fr - Milandre belette; Sp - Comadreja coluda.



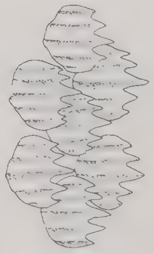


upper teeth from right side

Field Marks : A small, slender shark with a rounded, moderately long snout, large lateral eyes with nictitating eyelids, small spiracles, moderate-sized gill slits about 1.2 to 1.3 times eye length in adults (less in young), rather short arched mouth with upper labial furrows falling well behind symphyses of jaws, lower teeth not prominently protruding, upper teeth with distal cusplets but no serrations, lower anterior teeth with moderately long, nearly straight smooth-edged cusps, lower lateral teeth with low cusplets and mostly erect cusps, roots of lower teeth not strongly arched, anterior teeth T shaped, two spineless dorsal fins and an anal fin, second dorsal about 2/3 size of first, second dorsal origin slightly ahead of anal origin, anal fin smaller than second dorsal and without preanal ridges, transverse, crescentic precaudal pits, and light grey colour without prominent markings.



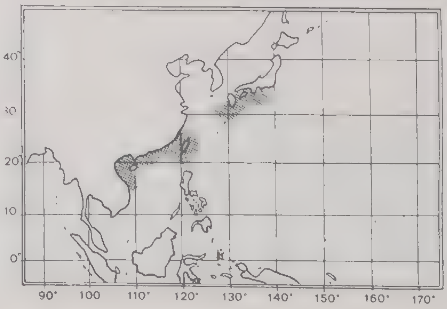
underside of head



dermal denticles

Diagnostic Features : Upper labial furrows falling behind lower symphysis; lower anterior and lateral teeth with low cusplets present on distal crown feet; lateral teeth with mostly erect cusps. Caudal vertebral centra 55 to 56, total vertebral counts 131 to 135.

Geographical Distribution : ? Western Pacific: Viet Nam, southern China (off Hong Kong), and Taiwan Island, Japan.



Habitat and Biology : A little-known inshore shark, depth range not reported.

Size : Adult males 78 to 88 cm long.

Interest to Fisheries : Taken in Taiwan Island, Hong Kong, and Japanese fisheries, and probably elsewhere where it occurs.

Literature : Chen (1963); Bessednov (1964); Compagno (1979).

Remarks : Synonymy and generic placement of this species follows Compagno (1979). Fourmanoir (1961) described a tengi-like shark from off Madagascar as Paragaleus pectoralis, but this may be an undescribed Paragaleus recently collected from off South Africa.

9.7 FAMILY CARCHARHINIDAE Jordan & Evermann, 1896

CARCH

Subfamily Carcharhininae Jordan & Evermann, 1896 (Family Galeidae), Bull.U.S.Nat.Mus., 48(1):28. The emended variant Family Carcharhinidae Garman, 1913 (original spelling Carcharinidae) was placed on the Official List of Family Group Names in Zoology by the International Commission on Zoological Nomenclature (1965, Opinion 723, 7b, Name no. 386).

Synonymy : Subfamily Triaenodontini Bonaparte, 1838 (Family Squalidae); Family Trianodontes Müller & Henle, 1839; Family Carchariae Müller & Henle, 1839 (placed on the Official Index of Rejected and Invalid Family-Group Names in Zoology by the International Commission on Zoological Nomenclature (1965, Opinion 723.8a, Name no. 413)); Family Nictitantes Owen, 1846 (no nomenclatural standing); Family Eulamiidae Fowler, 1928; Subfamily Galeocerdinae Whitley, 1934 (Family Galeidae); Subfamily Scoliodontidae Whitley, 1934 (Family Galeidae); Subfamily Loxodontinae Whitley, 1934 (Family Galeidae, not Subfamily Loxodontinae Osborn, 1918 in Family Elephantidae, Class Mammalia).

FAO Names : En - Requiem sharks; Fr - Requins; Sp - Cazones picudos, Tiburones, Tintoreras.

Field Marks : Small to large sharks with round eyes, internal nictitating eyelids, no nasoral grooves or barbels, usually no spiracles, a long, arched mouth that reaches past anterior ends of eyes, moderately long labial furrows, small to large, more or less bladelike teeth in both jaws, often broader in the upper jaw, two dorsal fins and an anal fin, the first dorsal fin moderate-sized to large and with its base well ahead of pelvic bases, the second dorsal fin usually much smaller than the first, precaudal pits present, caudal fin with a strong ventral lobe and lateral undulations on its dorsal margin, intestine with a scroll valve, and usually no colour pattern.

Diagnostic Features : Head without laterally expanded blades; eyes circular, vertically oval, or horizontally oval, their lengths 1.5 times their height or less; nictitating eyelids internal; spiracles usually absent (except for Galeocerdo; occasionally present in Loxodon, Negaprion and Triaenodon); anterior nasal flaps varying from lobular and tube-shaped (Triaenodon) to vestigial, not barbel-like; internarial width usually about 3 to 6 times the nostril width (exceptionally 1.5 times in Nasolamia); labial furrows varying from moderately long and conspicuous, to short and hidden when mouth is closed; teeth small to large, with acute and narrow to moderately broad cusps, sometimes lateral cusplets, but with basal ledges and grooves low or absent; teeth variably differentiated in upper and lower jaws, uppers often more compressed and bladelike, lowers often more cuspidate and not compressed; posterior teeth not comblike; tooth rows 18 to 60/18 to 56. Precaudal pits present. First dorsal fin moderate-sized to very large but not keel-like, much shorter than caudal fin; first dorsal base ahead of pelvic bases, varying from closer to pectoral bases to closer to pelvics; midpoint of first dorsal base always in front of pelvic origins; second dorsal fin usually much smaller than first (Lamiopsis and Negaprion are exceptions); pectoral fins with radials extending into distal web of fins; ventral caudal lobe strong, undulations or ripples present in dorsal caudal margin. Neurocranium without supraorbital crests. Vertebral centra with strong, wedge-shaped intermedial calcifications. Valvular intestine with a scroll valve. Colour variable, usually no colour pattern. Development usually viviparous.

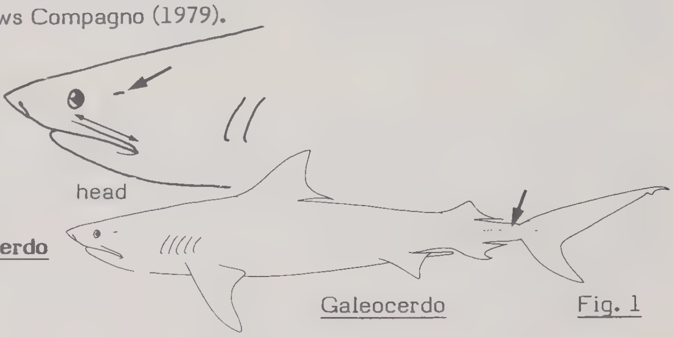
Habitat, Distribution and Biology : This is one of the largest and most important families of sharks, with many common and wide-ranging species found in all warm and temperate seas. These are the dominant sharks in tropical waters, often both in variety and in abundance and biomass. Most species inhabit tropical continental coastal and offshore waters; several species prefer coral reefs and oceanic islands while a few, including the blue, silky and oceanic whitetip sharks, are truely oceanic and range far into the great ocean basins. A minority of species range into temperate waters; one of these, the blue shark (Prionace glauca), has the greatest geographic range of any elasmobranch and one of the largest ranges of any marine vertebrate. Most requiem sharks are marine, ranging from close inshore to the outermost shelf edges near the bottom and the epipelagic zone, but none are truly specialized deepwater sharks, unlike many species of Squalidae and Scyliorhinidae. Although species in other families may enter river mouths and ascend rivers for a short distance, a few members of this family, particularly the bull shark (Carcharhinus leucas) but possibly also the little-known river sharks (Glyphis), apparently are the only living sharks that can live in fresh water for extended periods; the bull shark has a wide range in tropical and temperate rivers and lakes of the world. Requiem sharks are active, strong swimmers, occurring singly or in small to large schools. Some species are continually active, while others are capable of resting motionless for extended periods on the bottom. Many are more active at night or dawn and dusk than the daytime. At least some of the species have been shown to give specialized displays when confronted by divers or other sharks, which may be indicative of aggressive or defensive threat. Some species are relatively small, reaching about a metre long, but most requiem sharks are medium to large-sized, between 1 and 3 m long, and one species, the tiger shark, is one of the biggest sharks and may reach a length of 7.4 m. Except for the ovoviviparous tiger shark, all species are viviparous, with a yolk sac placenta, and have litters of young from 1 or 2 to 135. All are voracious predators, feeding heavily on bony fishes, other sharks, rays, squid, octopi, cuttlefishes, crabs, lobsters, and shrimp, but also sea birds, turtles, sea snakes, marine mammals, gastropods, bivalves, carrion, and garbage. Smaller species tend to select for a narrow range of prey, but certain very large species, especially the tiger shark (Galeocerdo) are virtually omnivorous. This family contains more dangerous species than any other; several of the larger requiem sharks have attacked people and boats while a few species (particularly the bull and tiger sharks) are among the most dangerous living sharks.

Interest to Fisheries: This is by far the most important shark family for fisheries in the tropics, and various species figure prominently in artisanal, commercial and sports fisheries. Most are utilized for human food, but also for the preparation of various subproducts, including oil and vitamin A from the liver, fishmeal, fins for the oriental soupfin market, and leather. Several species are the subjects of sports fisheries, and two species, the blue and tiger sharks, are listed as International Game Fish Association record species.

Remarks: The arrangement of this family follows Compagno (1979).

Key to Genera:

1a. Upper labial furrows very long, extending to front of eyes. Spiracles present and relatively large. Prominent lateral keels on caudal peduncle (Fig. 1). Vertical black or dusky bars on back, obscure or absent on adults .... Galeocerdo



Galeocerdo Fig. 1

1b. Upper labial furrows long to very short, not extending in front of eyes. Spiracles usually absent. Lateral keels usually absent (except for weak ones in Prionace) (Fig. 2)

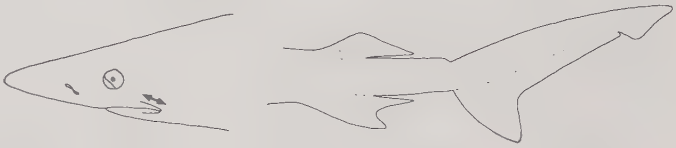


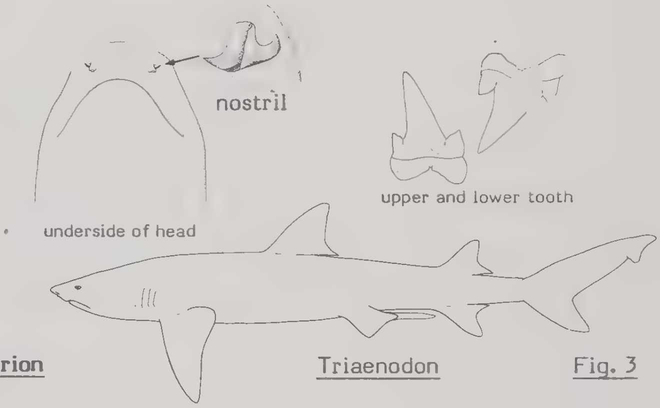
Fig. 2

  2a. High proximal and distal cusplets present on most teeth in both jaws. Expanded anterior nasal and mesonarial flaps forming a tube for the excurrent aperture (Fig. 3) .... **Triaenodon**

  2b. Cusplets usually absent on lower teeth, low or absent on uppers. (Fig. 4) Nasal flaps not forming a tube

    3a. Second dorsal fin nearly or quite as large as first dorsal (Fig. 5)

      4a. Snout short, preoral length much less than mouth width. Upper and lower teeth with narrow, unserrated cusps (Fig. 6) .... **Negaprion**



Triaenodon Fig. 3

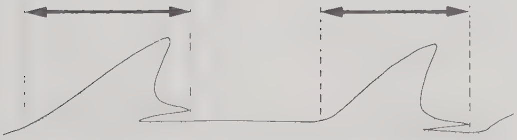


Fig. 5

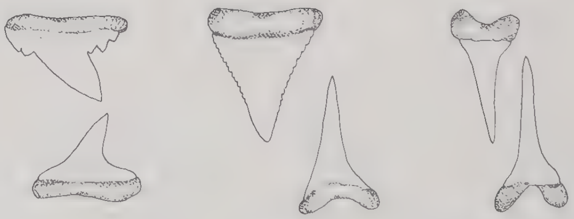
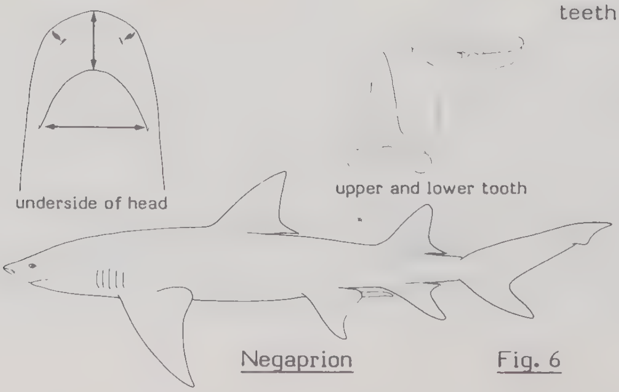


Fig. 4



Negaprion Fig. 6

4b. Snout longer, preoral length about equal to mouth width. Upper teeth with broad, triangular, serrated cusps, lowers with narrow, smooth cusps (Fig. 7)................................ **Lamiopsis**

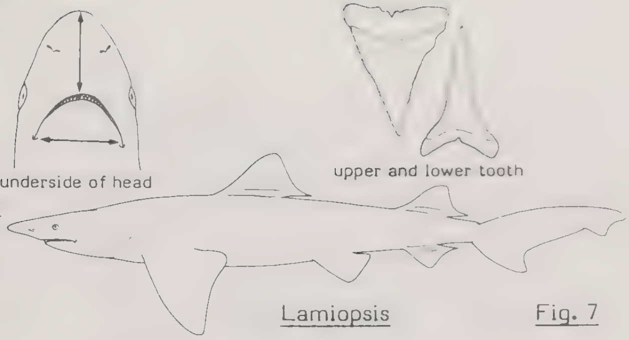
3b. Second dorsal fin considerably smaller than first (Fig. 8)

5a. Snout triangular and dagger-shaped in dorsoventral view, narrow and spearlike laterally (Fig. 9). Tooth rows 49 to 61/49 to 56............. **Isogomphodon**

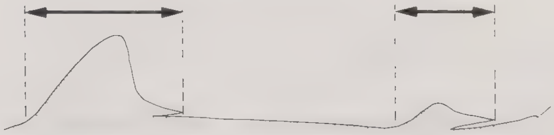
5b. Snout bluntly rounded to narrowly parabolic and pointed, not acutely triangular and spearlike (Fig. 10). Tooth rows 23 to 37/21 to 35 and usually less than 32/32

6a. Head greatly depressed and trowel-shaped. Pectoral fins broadly triangular, length from origins to free rear tips about equal to their anterior margins. Free rear tip of first dorsal about over mid-bases of pelvic fins. Post-ventral margin of caudal fin usually only shallowly concave (Fig. 11) .... **Scoliodon**

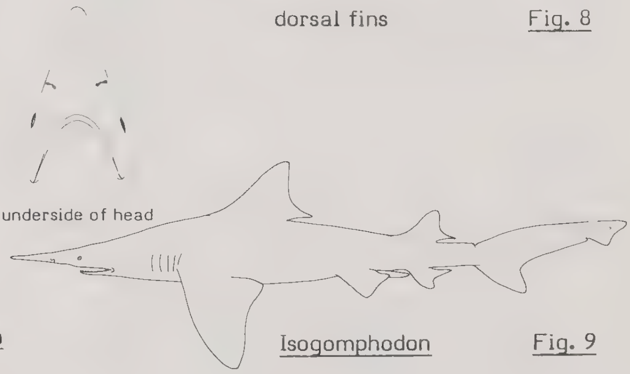
6b. Head varying from conical to slightly depressed. Pectoral fins narrower, length 4/5 or less of anterior margin (usually less). Free rear tip of first dorsal over or (usually) anterior to pelvic origins. Postventral margin of caudal deeply incised (Fig. 12)



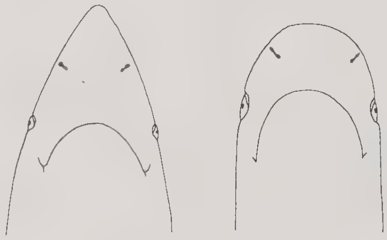
Lamiopsis Fig. 7



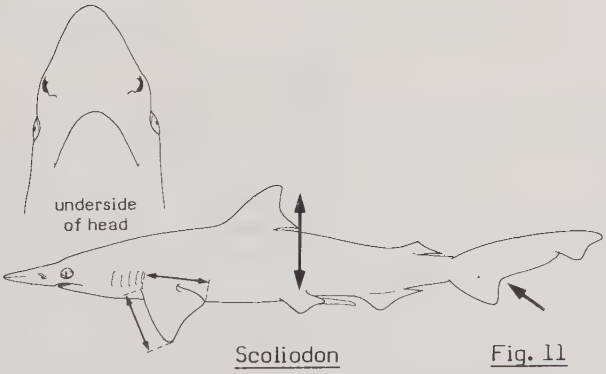
dorsal fins Fig. 8



Isogomphodon Fig. 9



underside of head Fig. 10



Scoliodon Fig. 11

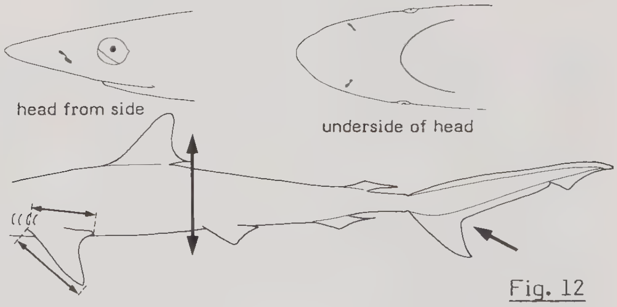
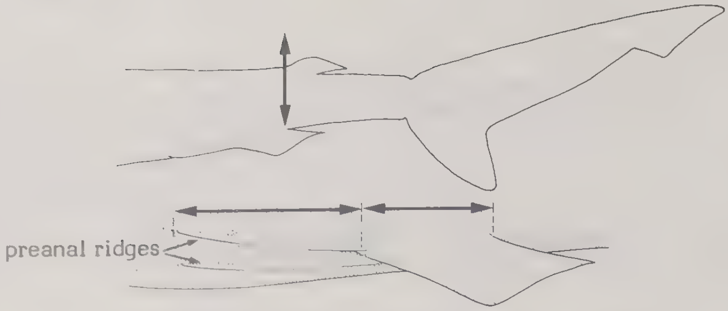


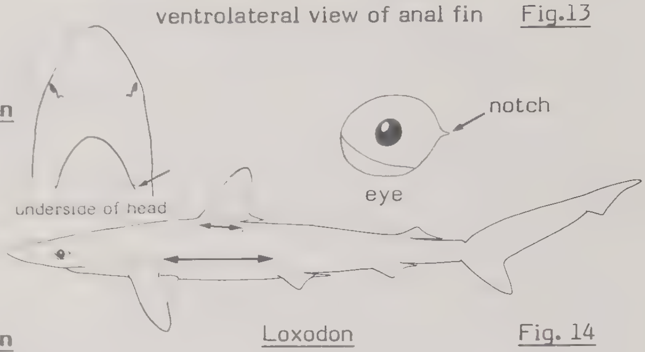
Fig. 12

7a. Second dorsal origin well behind anal origin, usually over or slightly anterior to anal insertion. Preanal ridges very long and prominent, subequal to or greater in length than anal base. Anal posterior margin straight or shallowly concave (Fig. 13)



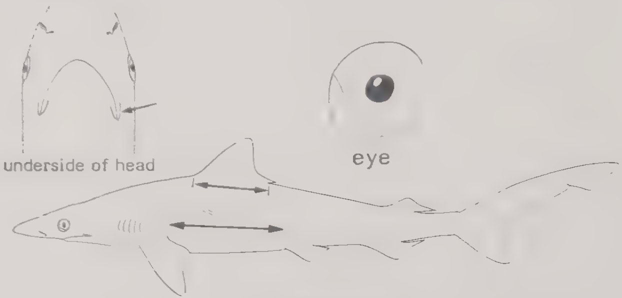
ventrolateral view of anal fin Fig.13

8a. Posterior notches present on eyes. Labial furrows reduced and confined to mouth corners. First dorsal base 2 to 3 times in distance between pectoral and pelvic bases (Fig. 14) .... **Loxodon**



Loxodon Fig. 14

8b. No eye notches. Labial furrows usually conspicuous and long, reduced in a few species (R. taylori and R. oligolinx). First dorsal base usually less than 2 times in distance between pectoral and pelvic bases (up to 2 in adult R. acutus) (Fig. 15) .... **Rhizoprionodon**

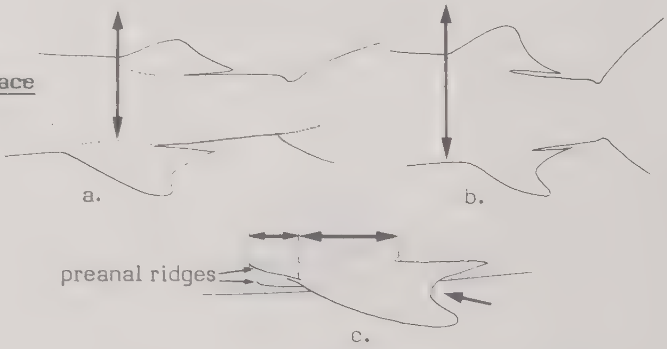


Rhizoprionodon Fig. 15

7b. Second dorsal origin usually near anal origin, in some species posterior to it (Fig. 16a), but usually well anterior to anal insertion (Fig. 16b) and midbase of anal (Carcharhinus borneensis and C. porosus may have the second dorsal origin above the space between anal midbase and insertion). Preanal ridges variably developed, short and half the anal base length or less (Fig. 16c). Posterior margin of anal fin deeply concave or deeply notched

9a. Papillose gillrakers present on gill arches (Fig. 17a). Weak lateral keels present on caudal peduncle. First dorsal base much closer to pelvic bases than pectorals (Fig. 18). Colour brilliant dark blue above in life .... **Prionace**

9b. No papillose gillrakers on gill arches (Fig. 17b). No lateral keels on caudal peduncle. First dorsal base equidistant between pectoral and pelvic bases or (usually) closer to pectorals (Figs 19,20,21). Colour light to dark grey, grey-brown, brown, or grey-black above



anal fin Fig. 16

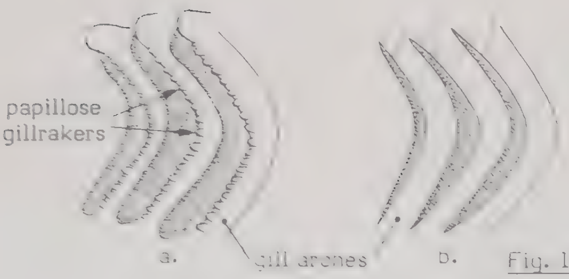
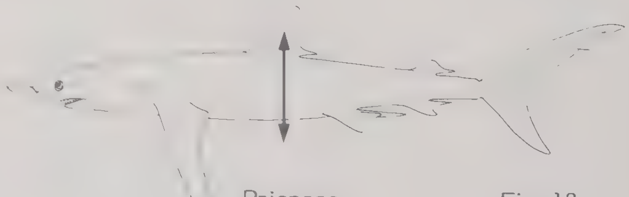


Fig. 17



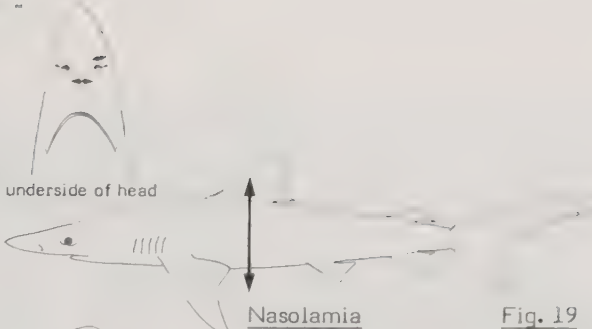
Prionace Fig. 18

10a. Snout very narrow, with nostrils large and close-set, internarial space 1.3 times nostril width or less (Fig. 19) .... **Nasolamia**

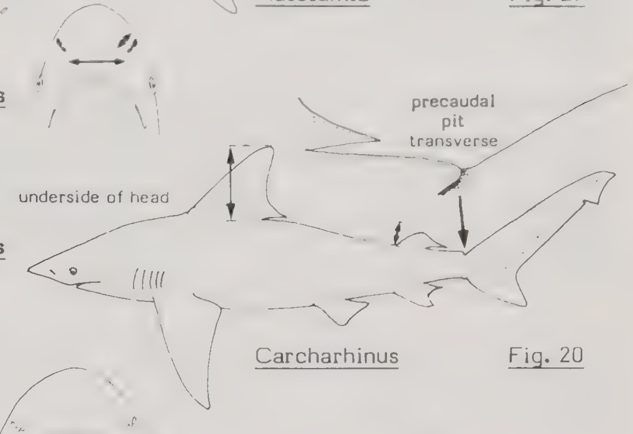
10b. Snout broader, with nostrils smaller and more widely spaced, internarial space at least 3 times nostril width (Figs 20,21)

  11a. Cusps of lower teeth not prominently protruding when mouth is closed. Second dorsal fin 2/5 height of first dorsal or less. Precaudal pits transverse and crescentic ... **Carcharhinus**

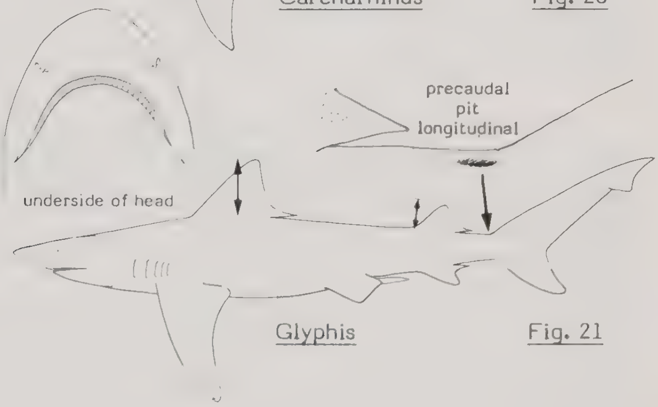
  11b. Cusps of lower teeth prominently protruding when mouth is closed. Second dorsal fin 1/2 to 3/5 height of first dorsal. Precaudal pits longitudinal and not crescentic .... **Glyphis**



Nasolamia Fig. 19



Carcharhinus Fig. 20



Glyphis Fig. 21

Carcharhinus Blainville, 1816

CARCH Carch

Genus : Subgenus Carcharhinus Blainville, 1816 (Genus Squalus Linnaeus, 1758), Bull.Soc.Philomat.Paris, 8:121.

Type Species : Carcharias melanopterus Quoy & Gaimard, 1824, by subsequent designation of the International Commission on Zoological Nomenclature, invoking the plenary powers to set aside all previous designations (Opinion 723.2c, 1965:32).

Synonymy : Subgenus Carcharias Cuvier, 1817 (Genus Squalus Linnaeus, 1758); also Subgenus Carcharias Risso, 1826 (Genus Squalus Linnaeus, 1758) and Genus Carcharias Müller & Henle, 1839 (placed on the Official Index of Rejected and Invalid Generic Names in Zoology by the International Commission on Zoological Nomenclature, Opinion 723.5c,d,e, Names nos. 1748, 1749 and 1750, respectively, 1965). Genus (? Subgenus) Carcharinus Cloquet, 1817 (placed on the Official Index of Rejected and Invalid Generic Names in Zoology by the International Commission on Zoological Nomenclature, Opinion 723.5h, Name no. 1753, 1965). Genus Aprion Müller & Henle, 1839 (a junior homonym of Aprion Cuvier & Valenciennes, 1830, in Osteichthyes). Subgenus Hypoprion Müller & Henle, 1839 (Genus Carcharias Müller & Henle, 1839). Subgenus Prionodon Müller & Henle, 1839 (Genus Carcharias Müller & Henle, 1839; a junior homonym of Prionodon Horsfield, 1822, in Mammalia and placed on the Official Index of Rejected and Invalid Generic Names in Zoology by the International Commission on Zoological Nomenclature, Opinion 723.5f, Name no. 1751, 1965). Genus Carcharorhinus Agassiz, 1843 (placed on the Official Index of Rejected and Invalid Generic Names in Zoology by the International Commission on Zoological Nomenclature, Opinion 723.5i, 1965). Genus Galeolamna Owen, 1853; Genus Aprionodon Gill, 1862 (replacement name for Aprion Müller & Henle, 1839); Genus Hypoprionodon Gill, 1862; Genus Eulamia Gill, 1862; Genus Platypodon Gill, 1862; Genus Isoplagiodon Gill, 1862; Genus Gymnorhinus Hilgendorf, in Hemprich & Ehrenberg, 1899 (junior homonym of Gymnorhinus Maximillian, 1841, in Aves); Genus Gymnorrhinus Hemprich & Ehrenberg, 1899; Genus Mapolamia Whitley, 1934; Genus Gillisqualus Whitley, 1934; Genus Galeolamnoides Whitley, 1934; Subgenus Ogilamia Whitley, 1939 (Genus Galeolamna Owen, 1853); Genus Longmania Whitley, 1939; Genus Uranga Whitley, 1943; Subgenus Uranganops Whitley, 1943 (Genus Galeolamna Owen, 1853); Subgenus Lamnarius Whitley, 1943 (Genus Galeolamna Owen, 1853); Subgenus Bogimba Whitley, 1943 (Genus

Galeolamna Owen, 1853). Genus Pterolamia Springer, 1950 (junior homonym of Pterolamia Breuning, 1942, in Insecta, and placed on the Official Index of Rejected and Invalid Generic Names in Zoology by the International Commission on Zoological Nomenclature, Opinion 723.5g, Name no. 1752, 1965). Genus Pterolamiops Springer, 1951 (replacement name for Pterolamia Springer, 1950; placed on the Official List of Generic Names in Zoology by the International Commission on Zoological Nomenclature, Opinion 723.3e, Name no.1661).

Nomina Nuda Referred to Carcharhinus : These are nomina nuda included by Blainville (1816) in his Subgenus Carcharhinus, but which are of uncertain identity: Squalus (Carcharhinus) lividus Blainville, 1816; Squalus (Carcharhinus) ustus Blainville, 1816; Squalus (Carcharhinus) heterodon Blainville, 1816; Squalus (Carcharhinus) broussonetii Blainville, 1816; Squalus (Carcharhinus) megalops Blainville, 1816; Squalus (Carcharhinus) heterobranchialis Blainville, 1816.

Species Dubia Referred to Carcharhinus : These include names with descriptions but which are of uncertain identity. Most of them are discussed by Garrick (1982). Carcharias javanicus van Hasselt, 1823; Carcharias fissidens Bennett, 1830/31 (possibly = Rhizoprionodon acutus ?); Thalassorhinus platyrhynchus Müller & Henle, 1839 (not based on a Carcharhinus ?); Carcharias (Prionodon) munsing Bleeker, 1849; Hypoprion/ Hemigaleus heterodus Philippi, 1887; Carcharias brachyrrhynchus Philippi, 1887; Carcharias (Prionodon) siamensis Steindachner, 1896; Carcharias robustus Philippi, 1896; Carcharias sanctae-thomae Engelhardt, 1912; Eulamia philippi Fowler, 1930 (replacement for C. brachyrrhynchus Philippi, 1887, not C. (Prionodon) brachyrhynchos Bleeker, 1859, = C. amboinensis).

Field Marks : Requiem sharks with small, wide-spaced nostrils, no spiracles, labial furrows confined to mouth corners, usually serrated upper teeth, no cusplets on lower teeth, no keels on caudal peduncle, transverse crescentic precaudal pits, first dorsal midbase closer to pectoral bases than to pelvics or at most about equidistant between them, second dorsal fin less than half the height of first, second dorsal origin usually about opposite anal origin, anal fin with preanal ridges short to absent and with a deeply notched posterior margin.

Diagnostic Features : Body fairly slender to very stout. Head narrow to broad, flattened but not trowel-shaped; snout varying from narrowly parabolic or subangular to bluntly rounded or nearly truncate in dorsoventral view, very short to long, with preoral length varying from about equal to much greater than internarial space and from much less to considerably greater than mouth width; eyes small to large, without posterior notches; spiracles absent; no papillose gillrakers on internal gill openings; nostrils small, internarial space 3 to 6 times nostril width; anterior nasal flaps short, varying from vestigial to narrowly or broadly triangular, but not tubular; labial furrows short, essentially confined to mouth corners, with uppers about as long as lowers or shorter, ends of uppers falling far behind eyes; teeth highly variable, anteroposteriors similar or strongly differentiated in upper and lower jaws; uppers usually with more or less erect, broad to narrow cusps, variably developed cusplets or blades, and serrations usually present; lowers without cusplets but with variably oblique to erect cusps and with serrations and blades present or absent; cusps of lower teeth no prominently protruding when mouth is closed; 24 to 37/23 to 35 rows of teeth, with most species not exceeding 33/33. Interdorsal ridge variably absent, present and prominent, or sometimes vestigial; no dermal keels on caudal peduncle; upper precaudal pit transverse and crescentic. First dorsal origin varying from over or slightly anterior to pectoral insertions to slightly behind their rear tips, midbase usually closer to pectoral bases than pelvics but sometimes equidistant between them, and free rear tip usually well in front of pelvic fins but occasionally opposite their origins; second dorsal fin much smaller than first, height 2/5 of first dorsal height or less; its origin usually about opposite anal origin but slightly anterior to it in some species and well behind it in others (but usually in front of anal insertion); pectoral fins varying from moderately broad and semifalcate, to narrow and falcate or broad-tipped, their lengths from origin to free rear tip about 1/3 to 2/3 of pectoral anterior margins; pectoral origins varying from about under 3rd to 5th gill slits; anal fin varying from considerably larger than second dorsal to about as large, with preanal ridges very short or absent and a deeply notched posterior margin. Colour variably grey, bronze, brownish above, without a colour pattern other than variable light or dark fin markings and lateral light stripes. Small to very large sharks, adults from below 1 to about 4 m.

Remarks : Following its revision by Garrick (1982), this is currently the largest genus of sharks, with some 29 species; although the writer predicts that it will be surpassed in number of species by the scyliorhinid genus Apristurus, and possibly by Mustelus. The arrangement of Carcharhinus adopted here follows Compagno (1979) and Garrick (1982) in most details. The genera Hypoprion and Aprionodon were recognized by most previous writers, but they are synonymized with Carcharhinus following the revisionary work on carcharhinid genera by Compagno (1979), and four species formerly included in these genera (A. isodon, H. macloti, H. hemiodon and H. signatus) are placed in Carcharhinus. In addition, there is apparently a new western Pacific species of porosus and borneensis-like shark (placed by Garrick, 1982, in the Western Hemisphere C. porosus but clearly not conspecific with that species), and a new C. amblyrhynchoides-like shark from the western Indian Ocean (J.A.F. Garrick, pers. comm.).

The 'river sharks', C. glyphis and C. gangeticus, were placed by Compagno (1979) in Carcharhinus, but following Garrick's (1982) revision of Carcharhinus and examination of more material of these sharks, these species are referred to the genus Glyphis.

The following key to species is derived from that of Garrick (1982), with considerable modifications.

Key to Species:

1a. Pectoral and first dorsal fins very broad distally and broadly rounded apically, only slightly tapering toward their apices. Most fin tips mottled white in adults, also black-tipped and with black dorsal saddle-marks on the caudal peduncle in juveniles .... **C. longimanus**

1b. Pectoral and first dorsal fins tapering distally and usually pointed or narrowly rounded. Fins not mottled white, often black tipped but without black saddles on the caudal peduncle

2a. First dorsal, pectoral, pelvic and caudal fins with extremely conspicuous white tips and posterior edges .... **C. albimarginatus**

2b. Fins not conspicuously tipped and edged with white, except first dorsal fin in C. wheeleri, plain, black-tipped, or with inconspicuous light edges

3a. Second dorsal fin with a conspicuous black tip but other fins plain

4a. First dorsal fin triangular, erect, and witih a posteroventrally sloping posterior margin. Usually 13/13 to 14 rows of anteroposterior teeth, and 28/27 to 29 total rows of teeth; distal cusplets serrated on upper anterolateral teeth. Pectoral length 1.4 to 1.8 in anterior margin length. Mouth width 6.4 to 8.3% of total length. Precaudal centra 54 to 74 .... **C. dussumieri**

4b. First dorsal fin falcate, with almost vertical posterior margin (apart from free rear tip). Usually 12/12 rows of anteroposterior teeth, and 26/25 total rows of teeth; distal cusplets smooth on upper anterolateral teeth. Pectoral length 1.7 to 2 in anterior margin length. Mouth width 4.2 to 6.6% of total length. Precaudal central 74 to 85 .... **C. sealei**

3b. Second dorsal fin plain, white or black-tipped but never the only fin with markings

5a. Caudal fin prominently edged with black along entire posterior edge. First dorsal fin plain or with a white tip but never black-tipped

6a. First dorsal fin with distinct white tip and posterior edge .... **C. wheeleri**

6b. First dorsal fin plain .... **C. amblyrhynchos**

5b. Caudal fin either plain or prominently edged with black, but if black, first dorsal fin also prominently black-tipped

7a. Upper anterolateral teeth with bent, hooked, narrow cusps .... **C. brachyurus**

7b. Upper anterolateral teeth variably shaped, and broad or narrow, but with cusps nearly straight

8a. Interdorsal ridge present

9a. Snout very long, narrow and pointed, internarial space 1.7 to 1.9 in preoral snout .... **C. signatus**

9b. Snout shorter, narrowly to broadly rounded, internarial space usually less than 1.6 in preoral snout

10a. Second dorsal, pectoral, and ventral caudal lobe strikingly black-tipped

11a. Second dorsal fin low, with very elongated inner margin over twice fin height. Upper anterolateral teeth with strongly serrated cusps; usually only 12 rows of upper anteroposterior teeth .... **C. sorrah**

11b. Second dorsal fin higher, with shorter inner margin 1.4 to 1.6 times fin height. Upper anterolateral teeth with smooth or weakly serrated cusps; 14 or 15 rows of upper anteroposterior teeth .... *C. hemiodon*

10b. Fins plain or dusky-tipped but not strongly black-tipped

12a. First dorsal origin well behind pectoral free rear tips. Very coarse serrations or small cusplets on feet of upper anterolateral teeth. Inner margin of second dorsal very long, usually over twice fin height (down to 1.6 times it) .... *C. falciformis*

12b. First dorsal origin over or anterior to pectoral free rear tips. Serrations on feet of upper anterolateral teeth small and not very coarse. Inner margin of second dorsal shorter and generally less than twice fin height (up to 2.1 times it in *C. obscurus*)

13a. Upper anterolateral teeth with narrow cusps; anteroposterior teeth in 13/12 rows or less .... *C. perezi*

13b. Upper anterolateral teeth with broad-based cusps, triangular in form; anteroposterior teeth in at least 14/13 rows

14a. First dorsal origin in front or over pectoral insertions or at least nearer to it than pectoral free rear tips

15a. Anterior nasal flaps usually low and inconspicuous. Distance from nostrils to mouth more than 2.4 times in mouth width. Upper anterolateral teeth moderately high; upper anterolateral teeth usually in 14 rows. First dorsal very high, with height about half predorsal space. Interdorsal ridge low .... *C. plumbeus*

15b. Anterior nasal flaps usually high and triangular. Distance from nostrils to mouth less than 2.4 times in mouth width. Upper anterolateral teeth very high; upper anterolateral teeth usually in 15 rows. First dorsal fin lower, with height much less than half predorsal space. Interdorsal ridge high .... *C. altimus*

14b. First dorsal origin opposite or somewhat in front of pectoral rear tips but closer to them than pectoral insertions

16a. Upper anterolateral teeth relatively high and narrow. Pectoral fins nearly straight. First dorsal fin higher and with a nearly straight anterior margin. Height of second dorsal fin 2.1 to 3.3% of total length and 1.3 to 1.7 times in inner margin length. Precaudal central 103 to 109 .... *C. galapagensis*

16b. Upper anterolateral teeth relatively low and broad. Pectoral fins more falcate. First dorsal fin lower and with a rounded anterior margin. Height of second dorsal fin 1.5 to 2.3% of total length and 1.6 to 2.1 times in inner margin length. Precaudal centra 89 to 95 .... *C. obscurus*

8b. Interdorsal ridge absent

17a. Entire posterior margin of caudal fin with a narrow but obvious black edge; pectoral, second dorsal and caudal fins with obvious black tips

18a. First dorsal fin with a broad black blotch at its apex, highlighted below with white .... *C. melanopterus*

18b. First dorsal fin with a narrow black edge on its anterior margin but without a black blotch at its apex .... *C. cautus*

17b. Posterior margin of caudal not black or only partly dusky or black; fins black-tipped or not

19a. Snout very short and broadly rounded, internarial space usually less than preoral length. Upper anterolateral teeth with very broad, triangular cusps and straight to concave distal margins; lower anterolaterals with strongly arched roots

20a. Usually 11 lower anteroposterior teeth, with extremely broad cusps. First dorsal height more than 3.1 times the second dorsal height. Second dorsal margin usually nearly straight. Angle of notch in anal posterior margin more acute, usually less than a right angle. Precaudal centra 89 to 95 .... C. amboinensis

20b. Usually 12 lower anteroposterior teeth, with moderately broad cusps. First dorsal height 3.1 times the second height or less. Second dorsal margin usually concave. Angle of notch in anal posterior margin more obtuse, usually a right angle or more. Precaudal centra 101 to 123 .... C. leucas

19b. Snout longer and parabolic or wedge-shaped to pointed, internarial space equal or greater than preoral length. Upper anterolateral teeth with narrow cusps and strongly notched distal margins; lower anterolaterals with nearly transverse roots

21a. Origin of second dorsal fin well behind anal origin, about opposite its midbase

22a. Upper anterolateral teeth with large mesial and distal cusplets and no serrations. Inner margin of first dorsal fin extremely long, about 2/3 of fin base. Rostrum expanded as a hypercalcified, hardened mass, easily detected by pinching or cutting into the snout .... C. macloti

22b. Upper anterolateral teeth with distal cusplets and serrations. Inner margin of first dorsal fin shorter, 1/2 fin base or less. Rostrum not hypercalcified

23a. Hyomandibular pores conspicuously enlarged alongside mouth corners. Anteroposterior teeth 11 to 12/11 to 12. Second dorsal lower, height 2.2 times or more in inner margin .... C. borneensis

23b. Hyomandibular pores not enlarged. Anteroposterior teeth 13 to 15/12 to 15. Second dorsal higher, height 1.9 times or less in inner margin .... C. porosus

21b. Origin of second dorsal fin about over anal origin

24a. Only 11 rows of anteroposterior teeth; lower anterolateral teeth with mostly oblique cusps. Snout tip with a dusky or black blotch .... C. acronotus

24b. Fourteen or more rows of upper anteroposterior teeth; lower anterolateral teeth with mostly erect cusps. Snout tip without a dark blotch

25a. Upper anterolateral teeth with semioblique cusps and strong cusplets. Gill slits shorter, longest 3% of total length. Pectoral fins rather broad and triangular, their lengths 1.5 in anterior margin length. Fins not black-tipped .... C. fitzroyensis

25b. Upper anterolateral teeth with erect or nearly erect cusps and no cusplets. Gill slits longer, longest usually at least 4% of total length. Pectoral fins narrower and falcate, their lengths 1.8 or more in anterior margin length. Fins often black-tipped

26a. Upper labial furrows noticeably elongated and prominent. Usually at least 16 rows of upper anteroposterior teeth. First dorsal fin lower, its height over 2.2 times in the interdorsal space; first dorsal origin over or just behind pectoral rear tips .... C. brevipinna

26b. Upper labial furrows shorter and less noticeable. Usually 15 or fewer rows of upper anteroposterior teeth. First dorsal fin higher, its height 2.2 times or less in interdorsal space; first dorsal origin over of just behind pectoral insertions

27a. Teeth with smooth edges in both jaws, except for weakly and irregularly serrated upper teeth of adults. Gill slits extremely long, longest about half of first dorsal base length. No black tips on fins .... C. isodon

27b. Teeth with serrated edges in both jaws. Gill slits shorter, much less than half of first dorsal base length. Fins usually black-tipped

28a. Snout rather short and wedge-shaped, internarial space 1 to 1.2 times in preoral snout. Second dorsal height 1 to 1.2 times in inner margin length .... ***C. amblyrhynchoides***

28b. Snout longer and pointed, internarial space 1.3 to 1.7 times in preoral snout. Second dorsal height 1.1 to 1.6 times in inner margin length .... ***C. limbatus***

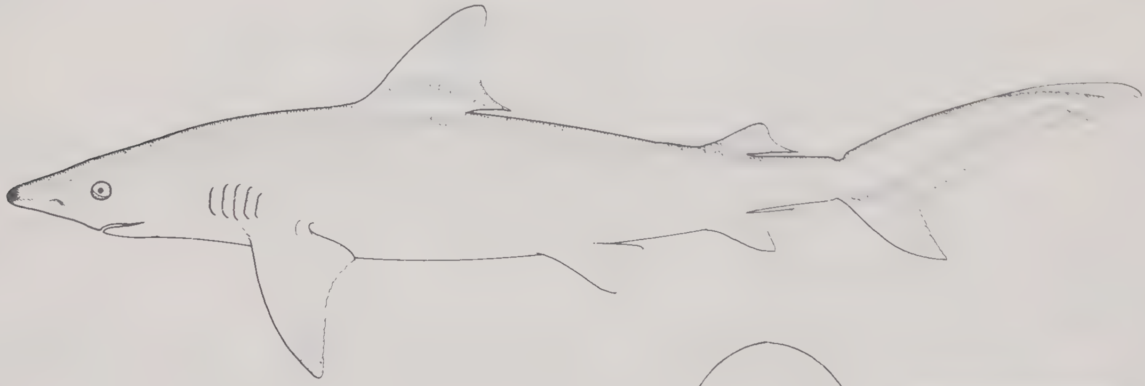
Carcharhinus acronotus (Poey, 1860)

CARCH Carch 1

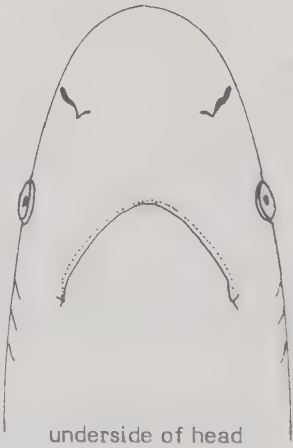
Squalus acronotus Poey, 1860, *Memorias*, 2:335, pl. 19, fig. 3-4. Holotype: Adult or adolescent male 980 mm, extant? Type Locality: Cuba.

Synonymy : ? *Prionodon curcuri* Castelnau, 1855 (see Garrick, 1982); *Carcharias* (*Prionodon*) *remotus* Dumeril, 1865.

FAO Names : En - Blacknose shark; Fr - Requin nez noir; Sp - Tiburón amarillo.



Field Marks : A small grey shark with a moderately long rounded snout, fairly large eyes, a black spot on the underside of the snout tip, oblique-cusped serrated teeth in both jaws, upper teeth without cusplets, usually 12/11 rows of anteroposterior teeth, no interdorsal ridge, small pectoral fins, a small first dorsal with a short rear tip and a moderately large second dorsal with a short rear tip, and dusky to blackish markings on the second dorsal and upper caudal tip.



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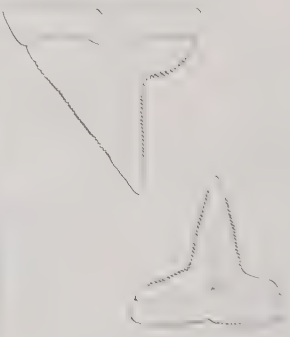
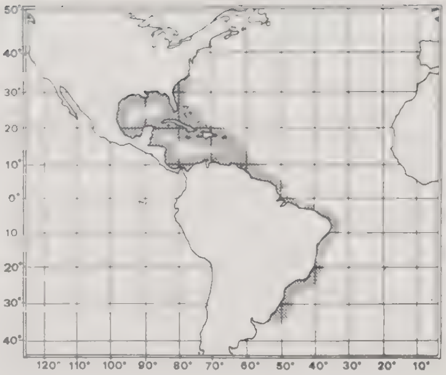


upper and lower tooth

Diagnostic Features : A small, relatively slender species (up to about 1.4 m). Snout moderately long and rounded; internarial width 1.4 to 1.7 times in preoral length; eyes horizontally oval or circular and moderately large, their length 1.6 to 1.7% of total length in specimens over 80 cm long; upper labial furrows short and inconspicuous; hyomandibular line of pores just behind mouth corners not conspicuously enlarged; gill slits short, third 2.7 to 3.2% of total length and less than a third of first dorsal base; usually 12/11 rows of anteroposterior teeth in each jaw half but varying from 12 to 13/11 to 12; upper teeth with moderately narrow, strongly serrated, strongly oblique cusps, and crown feet with slightly coarser serrations but no cusplets; lower teeth with slightly oblique serrated cusps and transverse roots. No interdorsal ridge. First dorsal fin small and semifalcate, with pointed or narrowly rounded apex and posterior margin curving ventrally from fin apex; origin of first dorsal fin over pectoral free rear tip; inner margin of first dorsal short, less than a third of dorsal base; second dorsal fin moderately large, its height 2.6 to 2.9% of total length, inner margin short and 1.1 to 1.3 times height; origin of second dorsal over or slightly behind anal origin; pectoral fins small, falcate, with narrowly rounded or pointed apices, length of anterior margins about 15% of total length in individuals above 80 cm long; 161 to 181 total vertebral centra, 80 to 88 precaudal centra. Black or dusky tips present on second dorsal, dorsal caudal lobe, and sometimes preventral edge of ventral caudal lobe; underside of snout with a conspicuous dusky to black blotch.



Geographical Distribution : Western Atlantic: North Carolina to Florida, Bahamas, Gulf of Mexico, Virgin Islands, Puerto Rico, Antilles, Guyana, Venezuela, southern Brazil.

Habitat and Biology : A common coastal tropical and warm-temperate shark of the continental and insular shelves, mainly over sandy, shell and coral bottoms. Off southwestern Florida pregnant females occur from January to April, and most individuals are caught from March through November, indicating a local migration.

Viviparous, with a yolk-sac placenta; number of young 3 to 6 per litter. Thought to mature in about two years; mates in spring.

The blacknose shark feeds on small fishes, including pinfish (Sparidae) and porcupine fish. This small, harmless shark is eaten by larger sharks. In captivity the blacknose shark performs a "hunch" display, with back arched, caudal lowered and head raised, when confronted by divers or newly-introduced conspecifics. This is thought to be a possible threat display.

Size : Maximum possibly 200 cm, males maturing between 97 and 106 cm, females maturing at about 103 cm and reaching at least 137 cm; size at birth between 38 and 50 cm.

Interest to Fisheries : Caught mainly off southeastern Florida and northeastern Venezuela, but also caught elsewhere in its range. Caught mainly on surface longlines and utilized dried salted for human consumption.

Literature : Bigelow & Schroeder (1948); Clark & von Schmidt (1965); Myrberg & Gruber (1974); Compagno & Vergara (1978); Garrick (1982).

Carcharhinus albimarginatus (Rüppell, 1837)

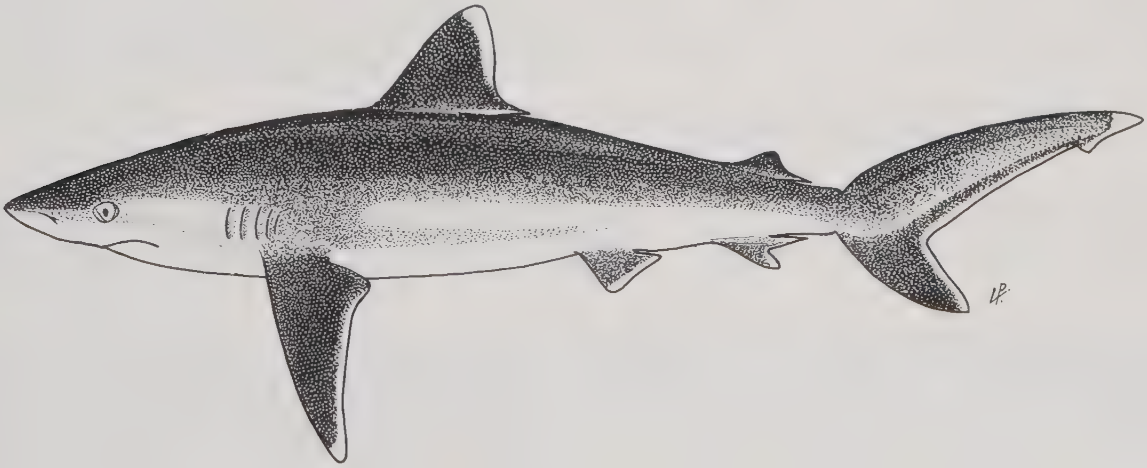
CARCH Carch 17

Carcharias albimarginatus Rüppell, 1837, Neues Wirbel.Fauna Abyssinien, Fische Rothen Meeres, (11):64, pl. 18, fig. 1. Lectotype: Naturmuseum Senckenberg, SMF 3582, 1025 mm stuffed immature male, designated by Klausewitz (1960:293). Type Locality: Ras Mehomet, Red Sea.

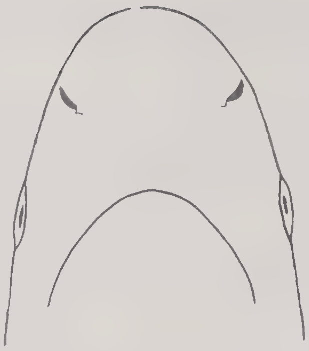
Synonymy : Eulamia (Platypodon) platyrhynchus Gilbert, 1892.

Other Scientific Names Recently in Use : Carcharhinus platyrhynchus (Gilbert, 1892).

FAO Names : En - Silvertip shark; Fr - Requin pointe blanche; Sp - Tiburón de puntas blancas.



Field Marks : A large, dark grey shark with strikingly conspicuous white tips and posterior margins on all fins, pectoral fins narrow tipped, first dorsal apex narrowly rounded or pointed.



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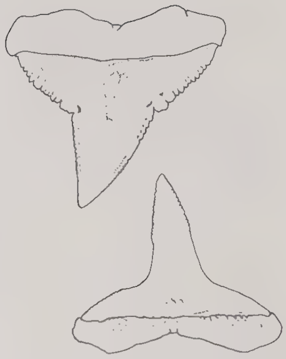
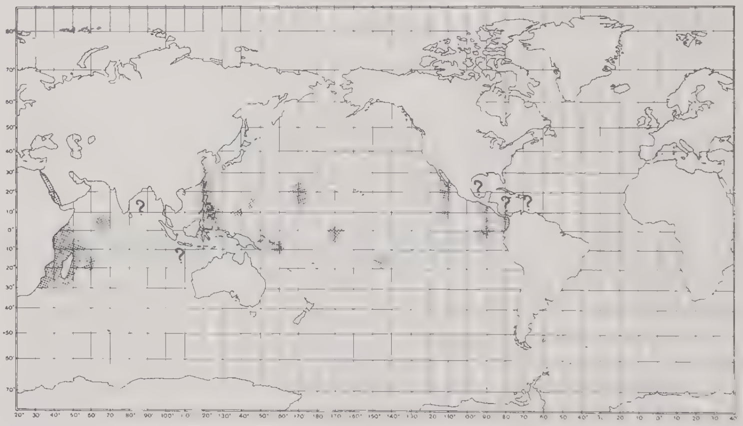


upper and lower tooth

Diagnostic Features : A large, fairly slender species (up to about 2.7 m). Snout moderately long and broadly rounded; internarial width 1 to 1.4 times in preoral length; eyes circular and moderately large, their length 1.8 to 3% of total length; anterior nasal flaps low and poorly developed; upper labial furrows short and inconspicuous; hyomandibular line of pores just behind mouth corners not conspicuously enlarged; gill slits short, the third 2.5 to 3.5% of total length and less than a third of first dorsal base; usually 13/12 rows of anteroposterior teeth in each jaw half, but varying from 12 to 14/12 to 14; upper teeth with moderately broad, strongly serrated, erect to moderately oblique, triangular, high cusps, and crown feet with slightly coarser serrations or low cusplets; lower teeth with erect, fairly broad serrated cusps and transverse roots. An interdorsal ridge present. First dorsal fin moderately large and semifalcate, with pointed or narrowly rounded apex and posterior margin curving ventrally from fin apex; origin of first dorsal fin usually over or slightly anterior to pectoral rear tips; inner margin of first dorsal moderately short, 2/5 dorsal base or less; second dorsal fin moderately large and high, its height 1.5 to 2.3% of total length, its inner margin moderately long and 1.5 to 2.1 times height; origin of second dorsal over or slightly behind anal origin; pectoral fins large and semifalcate, with narrowly rounded or pointed apices, length of anterior margins about 16 to 22% of total length; 216 to 231 total vertebral centra, 115 to 125 precaudal centra. Colour dark grey above, sometimes with a bronze tinge, white below; all fins with conspicuous white tips and posterior margins; an inconspicuous white band on flank.



Geographical Distribution : Western Indian Ocean: Red Sea, South Africa, Mozambique, Kenya, Madagascar, Aldabra group, Mauritius, Seychelles, Chagos Archipelago. Western central Pacific: Indonesia, (Macassar Straits), Taiwan Island, Guam New Caledonia, The Philippines, Palau, Marshall, Solomon and Phoenix Islands, Tahiti. Eastern Pacific: Southern Baja California, Revillagigedo, Clipperton, Cocos and Galapagos Islands south to Guatemala and Colombia. ? Western North Atlantic: ? Mexico, Gulf of Mexico and Caribbean Sea.

Habitat and Biology : A common to abundant, coastal-pelagic tropical, inshore and offshore shark, over or adjacent to continental and insular shelves and offshore banks, from the surface to 600 to 800 m depth. The silvertip shark has a strong preference for offshore islands, coral reefs and banks although it is not limited to them. It occurs from inside lagoons and near dropoffs to well offshore, but is not truely oceanic. It occurs along the water column from the surface to the bottom, and will often follow boats at the surface. Young silvertip sharks are restricted to shallower water closer to the shore while adults are more wide ranging, with little overlap with the young.

Viviparous, with a yolk-sac placenta; number of young 1 to 11 per litter, often 5 or 6. Young are born in the summer after a gestation period of about a year.

Feeds on a variety of midwater and bottom fishes, including lanternfish, flyingfish, gempylids, tuna, bonito, wahoo, bananafish, wrasses, soles, eagle rays, and octopi. At baits it is described as being more aggressive than Carcharhinus galapagensis and C. limbatus, with equal-sized silvertips dominating the Galapagos and blacktip sharks. It may swim at the periphery of a group of feeding sharks of other species, but suddenly dashes in to take some food.

Individuals of this species are said to be very aggressive to one another, and individuals often have evidence of combat scars. This species is regarded as dangerous to people, although few if any attacks can be attributed to it. Its large size, abundance around reefs and offshore islands, and boldness should invite respect and caution. A baited experiment in which a dummy dressed as a SCUBA diver had its leg removed by a large silvertip (Costeau & Costeau, 1970) suggests that it might be capable of fatally injuring a diver, especially when a food stimulus is in the water.

Size : Maximum about 300 cm, males maturing between 160 and 180 cm, females maturing between 160 and 199 cm; size at birth about 63 to 68 cm.

Interest to Fisheries : Specific information on fisheries for this species are lacking, but it is presumably taken in areas where it occurs (especially off the islands of the western Indian Ocean where it is abundant).

Literature : Beebe & Tee-Van (1941); Fourmanoir (1961); Wheeler (1962); Garrick & Schultz (1963); Limbaugh (1963); Gohar & Mazhar (1964); Kato, Springer & Wagner (1967); Kato & Carvallo (1967); Garrick (1967, 1982); Costeau & Costeau (1970); Bass, D'Aubrey & Kistnasamy (1973); Johnson (1978).

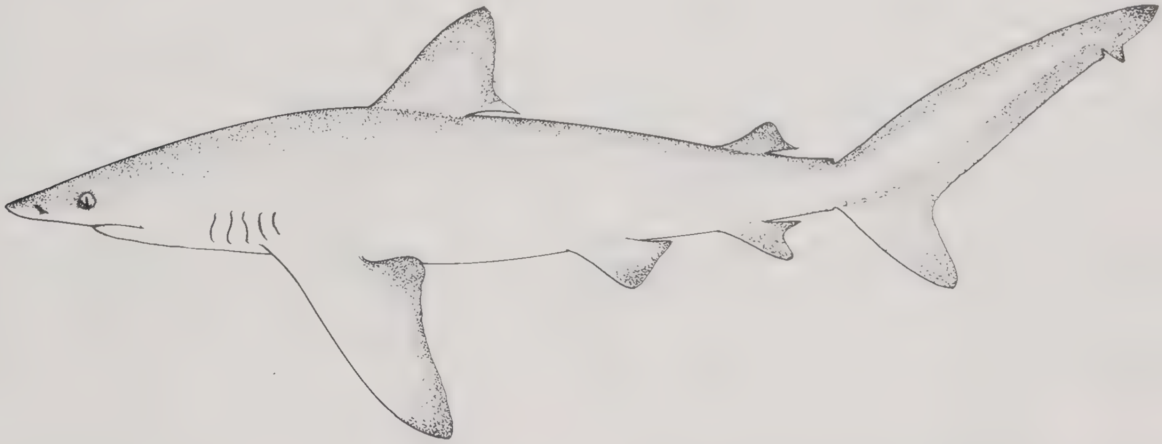
Carcharhinus altimus (Springer, 1950)

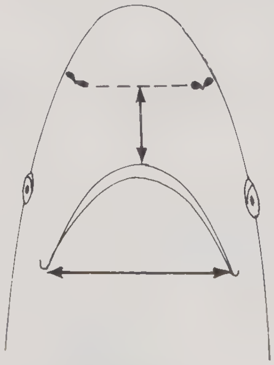
CARCH Carch 2

Eulamia altima Springer, 1950, *Am.Mus.Novit.*, (1451):9. Holotype: U.S. National Museum of Natural History, USNM 133828, 1320 mm immature female. Type Locality: Off Cosgrove Reef, Florida Keys, 174 m depth.

Synonymy : *Carcharhinus radamae* Fourmanoir, 1961.

FAO Names : En - Bignose shark; Fr - Requin babosse; Sp - Tiburón baboso.





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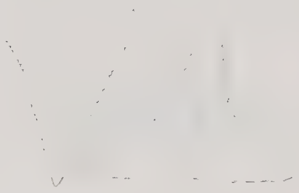
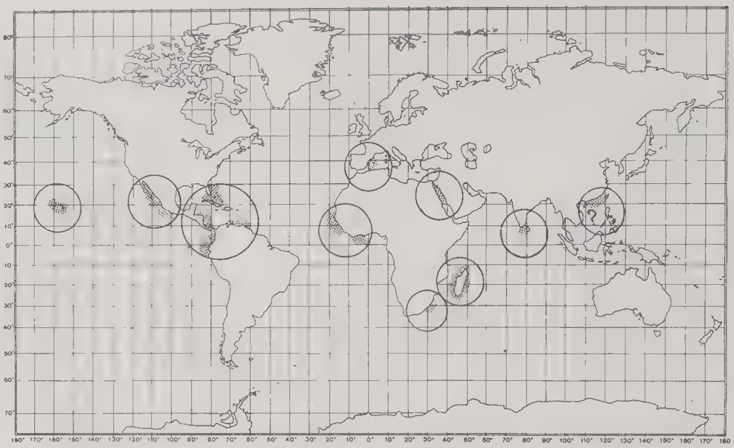


upper and lower tooth

Field Marks : A large, deep-benthic grey shark with a long rounded or bluntly pointed snout, prominent anterior nasal flaps, high, triangular, serrated teeth without cusplets in upper jaw, erect narrow-cusped serrated teeth in lower jaw, usually 15/14-15 rows of anteroposterior teeth, a high interdorsal ridge, moderately high first dorsal fin, long, nearly straight pectoral fins, a moderately high second dorsal with a short rear tip and no conspicuous markings.

Diagnostic Features : A large, fairly slender species (up to about 2.8 m). Snout moderately long and bluntly pointed to rounded; internarial width 1.3 to 1.4 times in preoral length; eyes circular and moderately large, their length 1.4 to 2.3% of total length; anterior nasal flaps rather high, triangular, and fairly broad; upper labial furrows short and inconspicuous; hyomandibular line of pores just behind mouth corners not conspicuously enlarged; gill slits moderately long, the third 3.1 to 3.9% of total length and about a third of first dorsal base; usually 15/14 to 15 rows of anteroposterior teeth in each jaw half but varying from 14 to 16/14 to 15; upper teeth with broad, strongly serrated, triangular, erect to slightly oblique, very high cusps that merge into the crown feet, the latter without coarse serrations or cusplets; lower teeth with erect, narrow serrated cusps and transverse roots. A prominent interdorsal ridge present. First dorsal fin moderately large and falcate, with bluntly pointed apex and posterior margin curving ventrally from fin apex; origin of first dorsal fin over pectoral insertion to about over midlength of pectoral inner margins; inner margin of first dorsal moderately long, half dorsal base or slightly less; second dorsal fin large and high, its height 2.8 to 3.4% of total length, its inner margin short and 1.1 to 1.4 times its height; origin of second dorsal slightly anterior to anal origin; pectoral fins large, hardly falcate, with narrowly rounded or pointed apices, length of anterior margins about 20 to 22% of total length; 194 to 206 total vertebral centra, 101 to 110 precaudal centra. Colour light grey above, sometimes bronzy, white below, with dusky fin tips (except for pelvics) but no conspicuous markings; white marking on flanks inconspicuous.

Geographical Distribution : Western Atlantic: Florida, Bahamas, Cuba, Nicaragua, Costa Rica, Venezuela. Eastern North Atlantic: Senegal, Gambia, Sierra Leone, Ivory Coast and Ghana. Mediterranean Sea. Western Indian Ocean: South Africa, Madagascar, India, Red Sea. ? Western Pacific: China. Central Pacific: Hawaii. Eastern Pacific: Gulf of California, southern Mexico, Colombia, Ecuador, Revillagigedo Islands.



Habitat and Biology : A common offshore, bottom-dwelling warm-temperate and tropical shark usually found in deeper water near the edge of the continental and insular shelves and the uppermost slopes, in depths of 90 m or more down to at least 250 to 430 m. The young may occur in shallower water, up to 25 m depth.

Development viviparous, number of young per litter 3 to 15. Mediterranean sharks give birth in August and September, Madagascar sharks September and October.

Eats a variety of bony fishes, including lizardfish, croakers, batfish, soles, other sharks including dogfish (Squalus), catsharks (Holohalaelurus), stingrays (Dasyatis), and cuttlefish. Although of large size, this species is probably not dangerous to people because of its deep-water habitat.

Size : Maximum possibly about 300 cm, mature males 216 to at least 267 cm, mature females 226 to 282 cm; size at birth probably between 70 and 90 cm.

Interest to Fisheries : Apparently regularly taken in the Caribbean region on deep-set longlines (especially off Cuba, but also southern Florida), and there utilized for fishmeal, oil and shagreen; also taken in bottom trawls in the western Indian Ocean and probably by line or gillnet off India.

Literature : Springer (1950); Fourmanoir (1961); Bass, D'Aubrey & Kistnasamy (1973); Garrick (1982), Morenos & Hoyos (1983).

Carcharhinus amblyrhynchoides (Whitley, 1934)

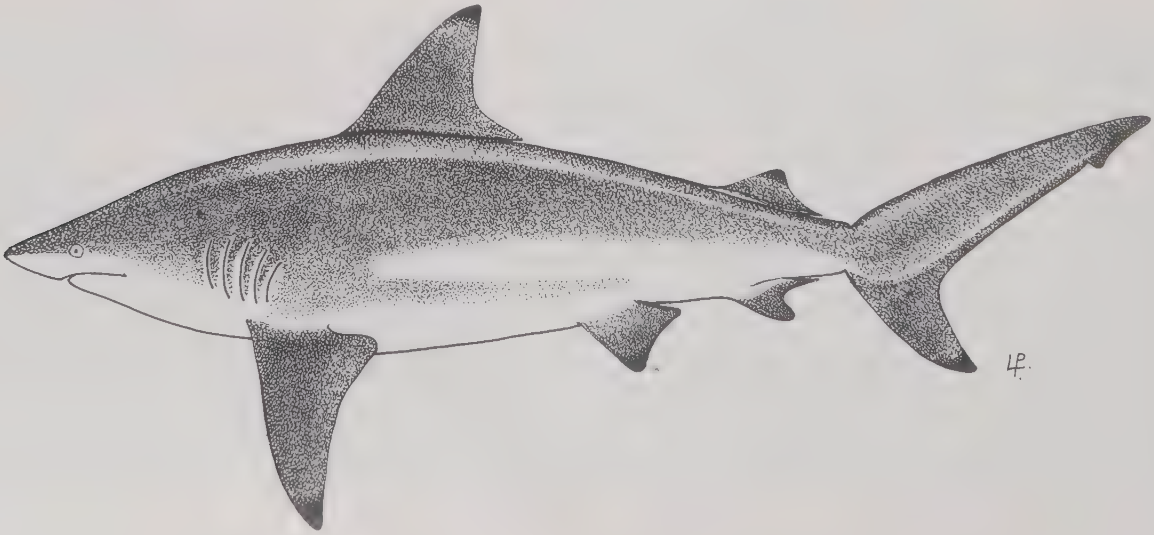
CARCH Carch 18

Gillisqualus amblyrhynchoides Whitley, 1934, Mem.Queensl.Mus., 10(4):189, fig. 4. Holotype: Queensland Museum, QMB I. 2003, 595 mm immature female. Type Locality: Cape Bowling Green, Queensland.

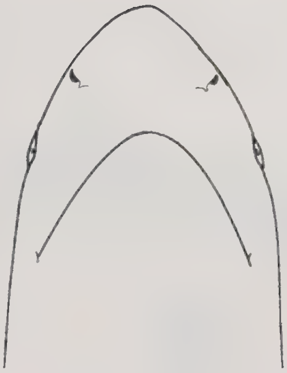
Synonymy : None.

Other Scientific Names Recently in Use : Carcharhinus pleurotaenia (Bleeker, 1852), = C. limbatus (Valenciennes, in Müller & Henle, 1839).

FAO Names : En - Graceful shark; Fr - Requin gracile; Sp - Tiburón grácil.



Field Marks: A moderately large, tubby grey shark with fairly short, wedge-shaped pointed snout, fairly large eyes, large gill slits, erect and narrow-cusped serrated teeth in both jaws, upper teeth without cusplets, 15/14 to 15 rows of anteroposterior teeth, no interdorsal ridge, moderately large pectoral fins, a large, triangular first dorsal with a short rear tip and a moderately large second dorsal with a short rear tip, a conspicuous white flank mark, and often black-tipped fins.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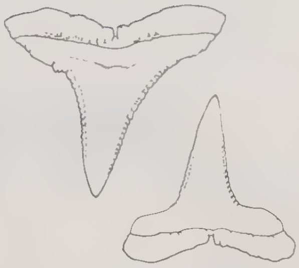
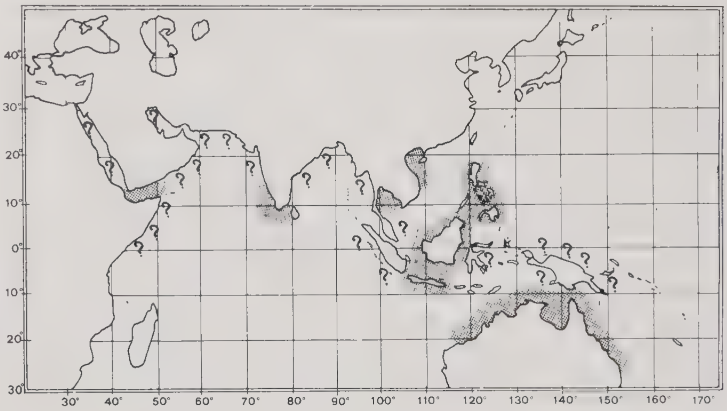

upper and lower tooth

Diagnostic Features: A moderate-sized, stout-bodied species (up to about 1.7 m total length). Snout short and moderately pointed; internarial width 1 to 1.2 times in preoral length; eyes circular and moderately large, 1.2 to 2.1% of total length; upper labial furrows short and inconspicuous; hyomandibular line of pores just behind mouth corners not conspicuously enlarged; 15/14 to 15 rows of anteroposterior teeth in each jaw half; upper teeth with narrow, strongly serrated, erect to slightly oblique cusps, and crown feet with slightly coarser serrations but no cusplets; lower teeth with erect, serrated cusps and transverse roots. No interdorsal ridge. First dorsal fin rather large, broadly triangular and semifalcate, with a pointed or narrowly rounded apex and posterior margin curving ventrally from apex; origin of first dorsal fin over or slightly posterior to pectoral insertion; second dorsal fin large and high, its height 3.1 to 3.7% of total length, its inner margin short and 1 to 1.2 times its height; origin of second dorsal about over or slightly in front of anal fin origin; pectoral fins rather large, falcate, and with narrowly rounded or pointed apex; length of pectoral anterior margins about 18 to 20% of total length in specimens 80 or more cm long; 168 to 193 total vertebral centra, 78 to 96 precaudal centra. Black tips usually present on pectorals, first and second dorsals, and ventral caudal lobe, and sometimes on pelvic fins, and dusky edges usually on dorsal caudal lobe; large adults may have dark fin markings obscure or obsolete. A conspicuous white band present on flank.

Geographical Distribution: Indo-West Pacific: Gulf of Aden, India (southwestern coast), Sri Lanka, Gulf of Thailand (Thailand), The Philippines, Viet Nam, Java, Borneo, Australia (Queensland, northwestern coast).



Habitat and Biology: A little-known but probably common tropical, inshore and offshore, coastal-pelagic species, found over the continental and insular shelves. Viviparous. Probably eats mostly fish as do its relatives *C. brevipinna* and *C. limbatus*. Harmless to people as presently known, but potentially dangerous.

Size: Maximum at least 167 cm (adult female), adult male 140 cm; size at birth about 52 to 55 cm.

Interest to Fisheries: Apparently caught by fisheries off Sri Lanka, India, the Gulf of Thailand, and elsewhere where this species occurs, but details of its fishery status are lacking. Probably caught in gillnets and with line gear, and eaten fresh and dried salted.

Literature: Whitley (1939, 1940); Fowler (1941); Garrick (1982).

Carcharhinus amblyrhynchos (Bleeker, 1856)

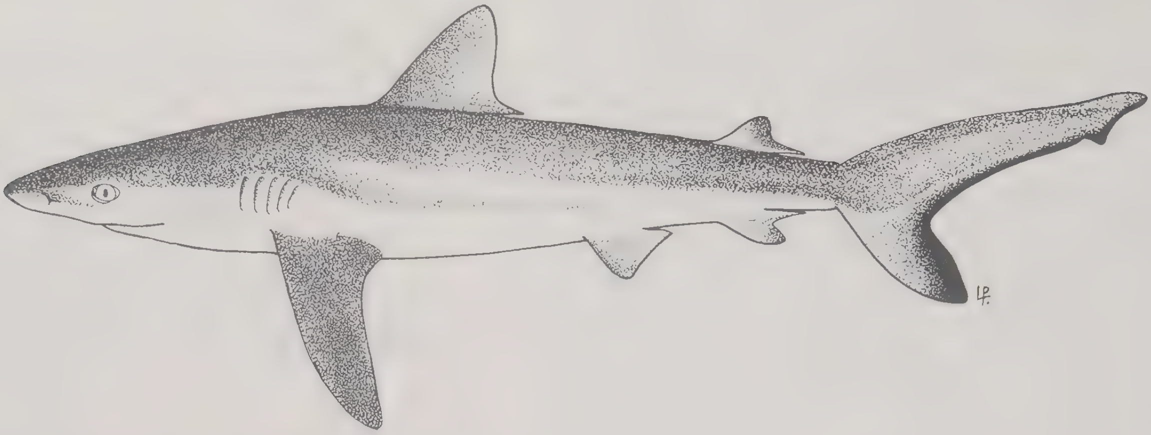
CARCH Carch 19

Carcharis (*Prionodon*) *amblyrhynchos* Bleeker, 1856, *Natuur.Tijdschr.Ned.Indië*, 6:467. Holotype: Rijksmuseum van Natuurlijke Historie, Leiden, RNH 7377, 1540 mm female. Type Locality: Java Sea near Salambo Islands.

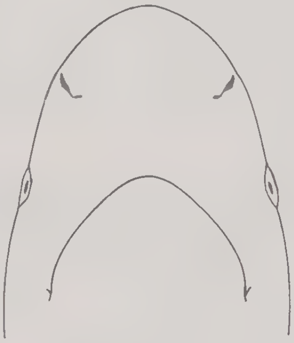
Synonymy: *Carcharias nesiodes* Snyder, 1904; *Galeolama fowleri* Whitley, 1944; *Galeolama tufiensis* Whitley, 1949; *Galeolama coongoola* Whitley, 1964.

Other Scientific Names Recently in Use: *Carcharhinus menisorrah* (Valenciennes, *in* Müller & Henle, 1839) = *C. falciformis* (Bibron, *in* Müller & Henle, 1839) as restricted by Garrick (1982).

FAO Names : En - Grey reef shark; Fr - Requin dagsit; Sp - Tiburón de arrecifes.



Field Marks : A medium-sized to large grey shark with a moderately long, broadly rounded snout, usually round eyes, no interdorsal ridge, narrow-cusped, serrated upper anteroposterior teeth, usually 14/13 on each side, large second dorsal fin with a short rear tip, and a broad black band on the posterior margin of the caudal fin.



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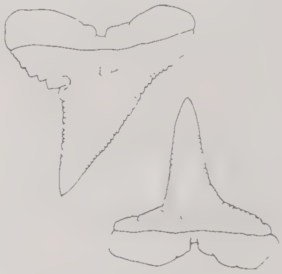
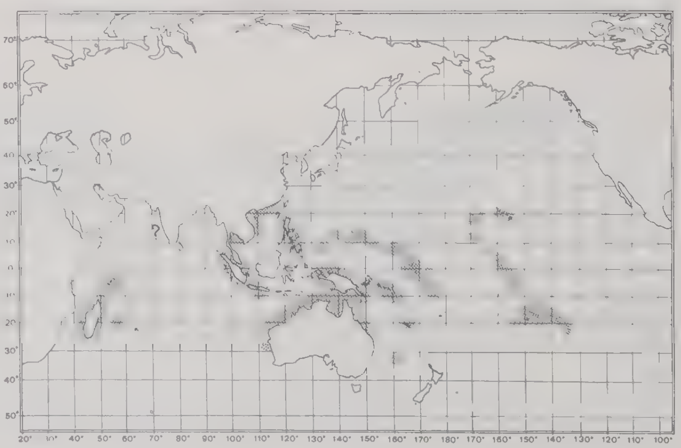


upper and lower tooth

Diagnostic Features : A moderate-sized fairly stocky species (to 2.4 m). Snout fairly long and broadly rounded; internarial width 1 to 1.4 times in preoral length; eyes usually round and fairly large, their length 2 to 2.7% of total length; anterior nasal flaps hardly expanded as very low triangular lobes; upper labial furrows short and inconspicuous; hyomandibular line of pores just behind mouth corners not conspicuously enlarged; gill slits moderate sized, the third 2.8 to 4.2% of total length and less than 2/5 of first dorsal base; usually 14/13 rows of anteroposterior teeth in each jaw half but varying from 13 to 14/13 to 14; upper teeth with narrow, strongly serrated, semierect to oblique, high cusps, and crown feet with coarser serrations and often distal cusplets; lower teeth with erect or semioblique, narrow serrated cusps and transverse roots. Usually no interdorsal ridge. First dorsal fin moderate-sized and semifalcate, with a narrowly rounded or pointed apex and posterior margin curving ventrally from fin apex; origin of first dorsal fin usually over or just in front of pectoral free rear tips; inner margin of first dorsal moderately long, but less than a half dorsal base; second dorsal fin moderately large and high, its height 2.7 to 3.4% of total length, its inner margin fairly long and 1.2 to 1.6 times its height; origin of second dorsal about over anal origin; pectoral fins moderately large, narrow and falcate, with narrowly rounded or pointed apices, length of anterior margins about 18 to 21% of total length; 211 to 221 total vertebral centra, 110 to 119 precaudal centra. Colour grey above, white below; first dorsal plain or irregularly white-edged, entire posterior margin of caudal (terminal, pre- and postventral margins) with a conspicuous broad black margin, pectorals, second dorsal, anal, and pelvic fins with blackish of dusky tips.

Geographical Distribution : Indian Ocean: Madagascar, Mauritius, Seychelles, ? India. Western central Pacific: Singapore, Thailand, Viet Nam, possibly China, The Philippines, Indonesia, New Guinea, Australia (Queensland and Western Australia) east to the Hawaiian Islands and the Tuamotu Archipelago; including New Caledonia and Lord Howe Island, Palau, Caroline Islands, Marshall Islands, Line Islands, Guam, Solomon Islands, Phoenix Islands, Gilbert Islands, Pitcairn Island, Johnston Island, Wake Island and Tahiti.



Habitat and Biology : A coastal-pelagic and inshore species frequenting continental and insular shelves of the Indo-West Pacific and oceanic waters adjacent to them; common on coral reefs, often in deeper areas near drop-offs to the open sea, in atoll passes, and in shallow lagoons adjacent to areas of strong currents. This shark is often found cruising near the bottom but will visit the surface, especially to investigate food sources; occurs at a depth from the surface and intertidal down to at least 100 m. Sonic-tagged individuals have been shown to venture several kilometres offshore at depths less than 100 m. This is one of the three commonest reef sharks in the Indo-Pacific (the others being the blacktip and whitetip reef sharks); it prefers low, small coral islands and has a preference for their leeward sides. It shows microhabitat separation from the blacktip reef shark; around islands where both species occur, the blacktip occupies shallow flats while the grey reef shark is usually found in deeper areas, but where the blacktip is absent the grey reef shark is commonly found on the flats.

This is an active, strong-swimming social species, that forms daytime schools or aggregations in favoured areas such as reef passes, lagoons, or places near passes. Especially prominent are groups of juveniles on probable pupping and nursery grounds. At night these groups disperse, with individuals moving to different areas. Although this shark is active during the day, it is more active nocturnally.

Viviparous, with a yolk-sac placenta; number of young 1 to 6 per litter. Gestation period about 12 months. Individuals mature at about 7 to 7.5 years, with a maximum age of at least 25 years.

Feeds on reef bony fishes, particular small fishes less than 30 cm long, but also squid, octopi, crabs, lobsters and shrimp. It feeds mostly off but near the bottom, but can capture bottom prey. It complements the whitetip reef shark, as it is far more adept at catching off-bottom fish than the whitetip, but the latter is far more competant in extracting prey from crevices and holes in reefs.

This shark is prone to investigate novel events in circumstances where food stimuli are not present. In seldom-frequented areas divers may be approached very closely by several of these sharks when they first enter the water, but the sharks soon disperse and seldom reappear except at a distance. Repeated dives at the same locality will seldom bring forth the local sharks, which apparently have sated their curiosity. When feeding stimuli are present or when these sharks are accosted they can be aggressive and dangerous despite their usually modest size. Spearfishing will bring these sharks in to boldly contest the catch and, although they generally can discriminate between speared fish and spearfisher, several attacks on people have occurred, including at least one fatal attack. These may be mistaken-identity attacks, especially when a speared fish moves very close to a diver, or when divers stupidly attach fish to their belts, as this shark does not normally take mammalian prey. Observations and subsequent experiments by divers (in some cases using small submarines) revealed that this shark performs what is apparently a threat-display when approached too closely, or when startled by unusual sounds or quick movements, under conditions when no feeding stimuli are present; presence of food stimuli apparently depresses this display. This consists of an exaggerated swimming pattern in which the shark wags its head and tail in broad sweeps, arches its back, lifts its head, depresses its pectoral fins and sometimes swims in a horizontal spiral. The display varies in intensity from merely a component of flight from the accosting diver to a series of figure-8 loops in front of the aggressor. Using a small shark-shaped 'Shark Observation Submersible' to approach grey reef sharks, Dr Donald R. Nelson was able to elicit threat display from the sharks while other divers filmed the behaviour from a safe distance. When persistantly approached by the sub, some of the displaying sharks fled, but a few terminated the display and attacked the sub at high speed, biting one or more times and then fleeing. The speed of the attacks and the damage to the sub was impressive, and is a mute warning that these sharks should be treated with respect and not cornered or harassed by divers. The threat-display behaviour of this shark is thought by some researchers to possibly intimidate potential predators on it.

Size : Maximum possibly 233 to 255 cm, adult males maturing at 130 to 145 cm, adult females maturing at 122 to 137 cm; most adults of either sex below 190 cm, but one male reportedly 255 cm; size at birth between 45 and 60 cm.

Interest to Fisheries : Fished in Thailand, but details of fisheries there and elsewhere not recorded.

Literature : Bass, D'Aubrey & Kistnasamy (1973); Johnson & Nelson (1973); Johnson (1978); Nelson (1981, and pers. comm.); Garrick (1982).

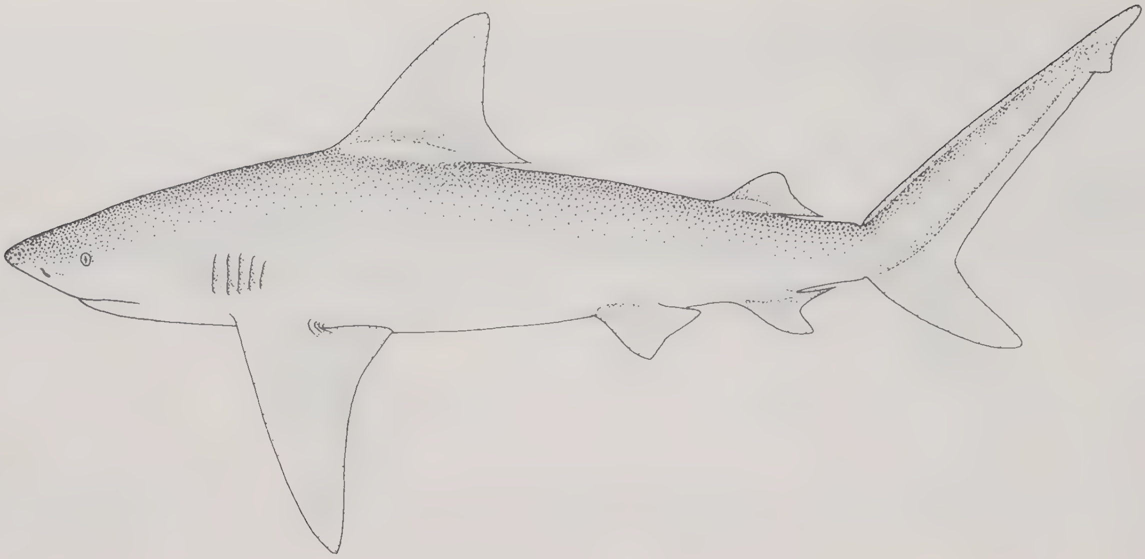
Carcharhinus amboinensis (Müller & Henle, 1839)

CARCH Carch 14

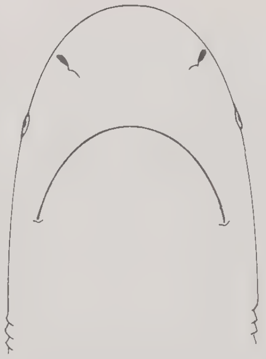
Carcharias (Prionodon) amboinensis Müller & Henle, 1839, Syst.Beschr.Plagiost., (2):40, pl. 19. Holotype: Rijksmuseum van Natuurlijke Historie, Leiden, RHN 2582, stuffed female about 740 mm. Type Locality: Amboina.

Synonymy : Carcharias (Prionodon) henlei Bleeker, 1855 (not Carcharias (Prionodon) henlei Valenciennes, in Müller & Henle, 1839 = Carcharhinus porosus); Carcharis (Prionodon) brachyrhynchos Bleeker, 1859; Triaenodon obtusus Day, 1878.

FAO Names : En - Pigeye shark; Fr - Requin balestrine; Sp - Tiburón baleta.



Field Marks : A large, stout grey shark with a very short, bluntly rounded snout, small eyes, broadly triangular serrated teeth in upper jaw, extremely heavy, slightly narrower cusped teeth with arched roots in lower jaw, upper teeth without cusplets, usually 12/11 rows of anteroposterior teeth, no interdorsal ridge, large angular pectoral fins, a large triangular first dorsal with a short rear tip and a small second dorsal with a short rear tip, fins with dusky tips but not strikingly marked.



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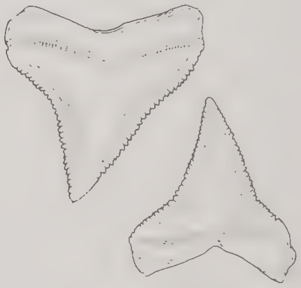
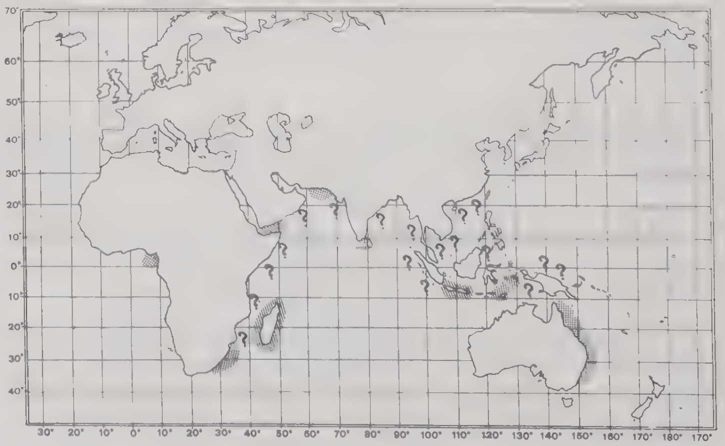


upper and lower tooth

Diagnostic Features : A large, stocky to very heavy-bodied species (up to about 2.8 m). Snout very short and bluntly and broadly rounded; internarial width 0.9 to 1 times in preoral length; eyes circular and small, their length 0.7 to 1.5% of total length; upper labial furrows short and inconspicuous; hyomandibular line of pores just behind mouth corners not conspicuously enlarged; gill slits moderately long, the third 2.9 to 3.8% of total length but less than a third of first dorsal base; usually 12/11 rows of anteroposterior teeth in each jaw half but varying from 11 to 13/10 to 12; upper teeth with broad, triangular, strongly serrated, erect to slightly oblique cusps, that merge smoothly with the coarsely serrated crown feet, but with no cusplets; lower teeth with erect semioblique, very broad serrated cusps and arched roots. No interdorsal ridge. First dorsal fin large and broadly triangular or somewhat falcate, with pointed or sharply rounded apex and posterior margin curving ventrally or posteroventrally from fin apex; origin of first dorsal fin over or just behind pectoral insertions; inner margin of first dorsal short, less than a third of dorsal base or slightly less; second dorsal fin moderate-sized, its height 2.8 to 3.6% of total length, its inner margin short and 0.9 to 1.3 times its height; origin of second dorsal anterior to anal origin; pectoral fins large and broad, triangular to semifalcate, with narrow, pointed apices, length of anterior margins about 20 to 24% of total length; 185 to 195 total vertebral centra, 89 to 95 precaudal centra. Colour grey above, light below, fin tips dusky, especially in young, but not strikingly marked; an inconspicuous white band on flank.

Geographical Distribution : Eastern North Atlantic: Nigeria. Indo-West Pacific: South Africa, Madagascar, Gulf of Aden, Pakistan, Sri Lanka, Indonesia (Java, Amboina, Aru and Lomblen Islands), Australia (Queensland, New South Wales).



Habitat and Biology : An inshore species of the continental and insular shelves, common in shallow waters close inshore, near the surf line and along beaches, from 0 to 60 m depth. In the southeastern Indian Ocean it is far less common on the western side of the Mozambique channel than C. leucas, but the reverse may apply to the eastern side off Madagascar, where it is described as abundant and C. leucas is apparently rare. It is thought that competitive exclusion may be operational here, but this is uncertain.

Apparently viviparous, but little is known of its reproductive biology.

Preys primarily on bottom fishes, crustaceans and molluscs. Takes bony fishes, including croakers, soles, and hairtails, sharp-nosed sharks and other species, skates, shrimp, cuttlefish, sea snails and whale meat probably as carrion.

This species should be considered as potentially dangerous because of its size and proportionately large jaws and teeth. However, no shark attacks can be attributed to it.

Size : Maximum 280 cm, males maturing at about 195 cm, females maturing at about 198 to 223 cm; size at birth about 71 to 72 cm.

Interest to Fisheries : Details of fisheries catching this species are sketchy, but apparently taken by longlines in the western Indian Ocean. Utilized fresh for human consumption.

Literature : D'Aubrey (1964, 1971); Garrick (1967, 1982); Bass, D'Aubrey & Kistnasamy (1973); Compagno (1979).

Remarks : The pigeye shark has generally been confused with C. leucas and Glyphis gangeticus. Characters distinguishing it from leucas are listed under the latter species. This species differs from G. gangeticus by the characters differentiating C. leucas from it (see remarks under that species), but additionally has even broader-cusped lower teeth and an even smaller first dorsal fin.

Triaenodon obtusus Day, 1878 has generally been considered a member of that genus (Taniuchi, 1975, Randall, 1977, Compagno, 1979), but examination of the holotype in the Zoological Survey of India, Calcutta (ZSI 2277, ca. 48 cm skin in alcohol, from Karachi, Pakistan), revealed that the species is based on a term fetus of Carcharhinus amboinensis (see also the account of the genus Triaenodon, below).

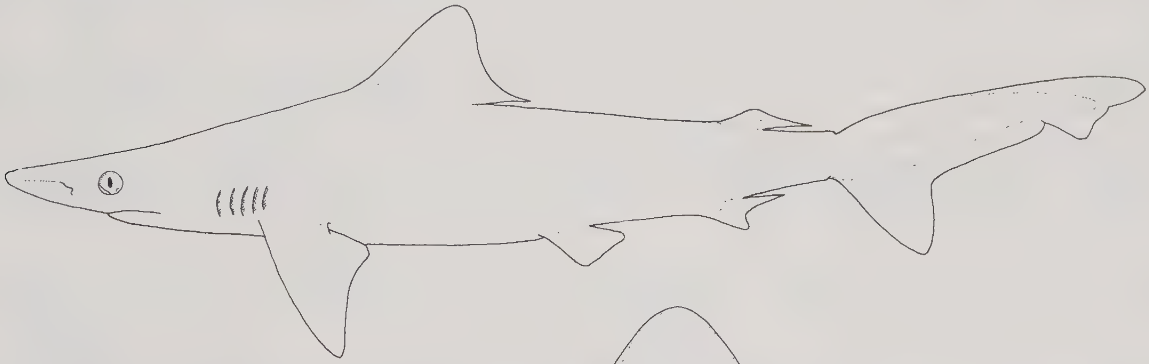
Carcharhinus borneensis (Bleeker, 1859)

CARCH Carch 27

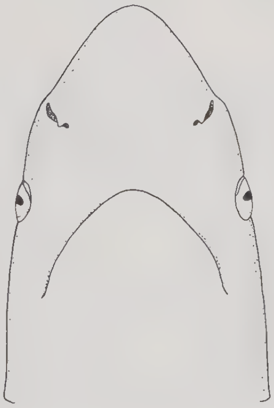
Carcharias (Prionodon) borneensis Bleeker, 1859, Acta Soc.Sci.Indo-Neerl., 1858, 59, 8. Holotype: Rijksmuseum van Natuurlijke Historie, Leiden, RNH 7386, 238 mm immature male. Type Locality: Singkawang, Borneo.

Synonymy : None.

FAO Names : En - Borneo shark; Fr - Requin-tigre houareau; Sp - Tiburón de Borneo.



Field Marks : A small grey shark with a long pointed snout, unique (for the genus) enlarged hyomandibular pores alongside mouth corners, large eyes, oblique-cusped serrated teeth in both jaws, upper teeth with cusplets, usually 12/11 rows of anteroposterior teeth, no interdorsal ridge, small pectoral fins, a small first dorsal with a short rear tip and a small low second dorsal with a short rear tip and its origin about over the anal midbase, and no conspicuous markings on the fins.



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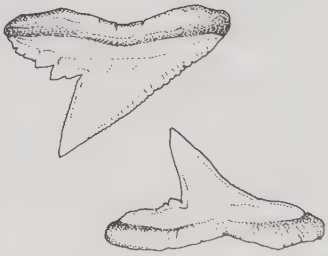


upper and lower tooth

Diagnostic Features : A small, slender species (up to possibly 1 m). Snout long and pointed; internarial width 1.3 to 1.5 times in preoral length; eyes circular and moderately large, their length 2.1 to 2.6% of total length; anterior nasal flaps high and narrow, nipple-shaped; upper labial furrows short and inconspicuous; hyomandibular line of pores just behind mouth corners conspicuously enlarged; gill slits short, the third 2.5 to 2.9% of total length and less than a third of first dorsal base; usually 12/11 rows of anteroposterior teeth in each jaw half but varying from 11 to 12/11 to 12; upper teeth with narrow, strongly serrated, oblique, moderately high cusps, and crown feet with large distal cusplets; lower teeth with oblique narrow serrated cusps, weak cusplets or large serrations and transverse roots. No interdorsal ridge. First dorsal fin moderately large and triangular, with bluntly pointed apex and posterior margin curving posteroventrally from fin apex; origin of first dorsal fin slightly anterior to pectoral rear tips; inner margin of first dorsal moderately long, half dorsal base or slightly less; second dorsal fin small and low, its height 1.8 to 2% of total length, its inner margin long and 2.2 to 2.4 times its height; origin of second dorsal over or slightly behind anal midbase; pectoral fins small, falcate, with narrowly rounded or pointed apices, length of anterior margins about 13 to 14% of total length; 118 to 121 total vertebral centra, 61 to 63 precaudal centra. Colour brown above, white below, tip of first dorsal and dorsal caudal margin dusky, paired fins and anal fin with light edges, but markings not conspicuous.

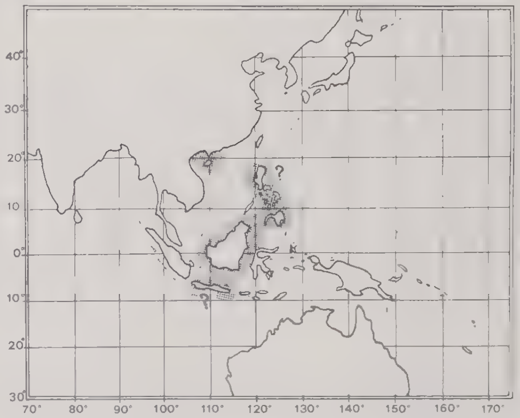
Geographical Distribution : Indo-West Pacific: ? Java, Borneo, China, ? The Philippines.

Habitat and Biology : A rare coastal, inshore, tropical shark, with biology virtually unknown.

Size : Maximum estimated at about 70 cm.

Interest to Fisheries : Apparently rare, but undoubtedly taken in local fisheries.

Literature : Fowler (1941); Compagno (1979); Garrick (1982).



Carcharhinus brachyurus (Günther, 1870)

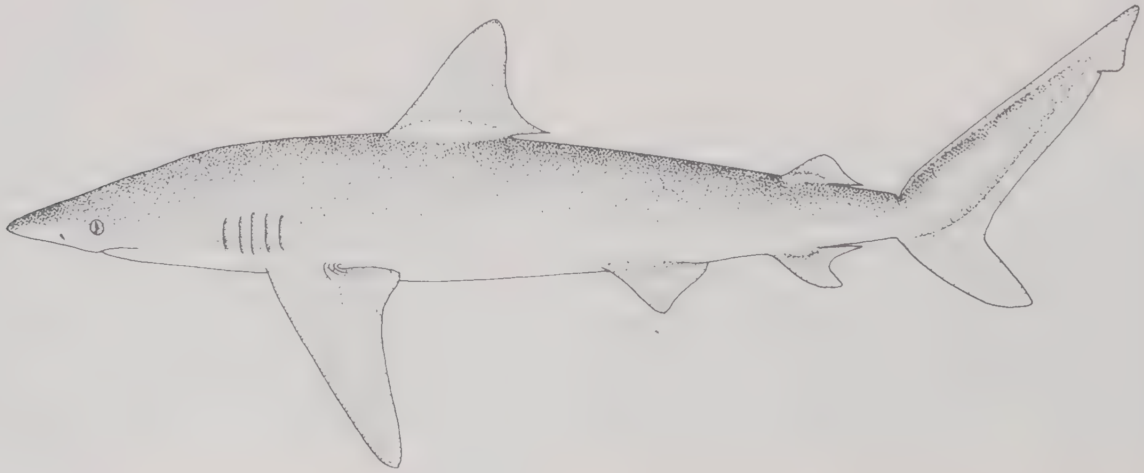
CARCH Carch 15

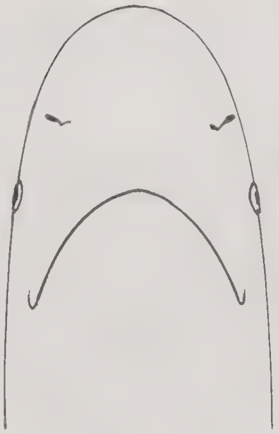
Carcharias brachyurus Günther, 1870, Cat.Fish.British Mus., 8:369. Neotype: National Museum of New Zealand, NMNZ 2262, 2420 mm female, Wanganui, New Zealand, designated by Garrick (1982:174). New Zealand type material of C. brachyurus in British Museum (Natural History) are apparently lost, and two Australian fetuses referred to the species by Günther (1870) are C. leucas (Garrick, 1982). Type Locality: New Zealand.

Synonymy : Carcharias lamiella Jordan & Gilbert, 1882; Eulamia ahenea Stead, 1938; Carcharhinus improvisus Smith, 1952; Carcharhinus rochensis Abella, 1972; Carcharhinus remotoides Deng, Xiong & Zhan, 1981; Carcharhinus acarenatus Morenos & Hoyos, 1983.

Other Scientific Names Recently in Use : Carcharhinus remotus (not Carcharias (Prionodon) remotus Dumeril, 1865 = Carcharhinus acronotus).

FAO Names : En - Copper shark; Fr - Requin cuivre; Sp - Tiburón cobrizo.





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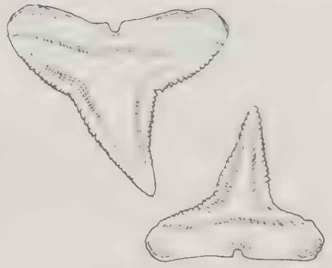
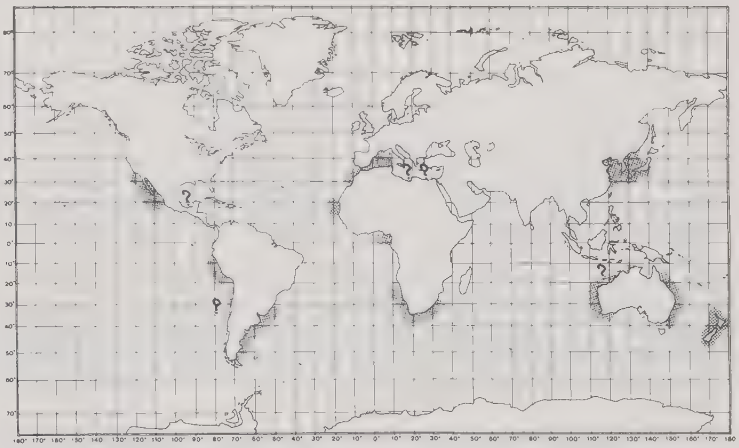


upper and lower tooth

Field Marks : A large, often bronzy grey shark with a moderately long narrowly rounded or pointed snout, narrow and bent-cusped serrated anterolateral teeth without cusplets in the upper jaw usually 15 to 16/15 rows of anteroposterior teeth, usually no interdorsal ridge, long pectoral fins, a small first dorsal with a short rear tip and a small second dorsal with a short rear tip, and no conspicuous markings on the fins.

Diagnostic Features : A large, fairly slender species (up to about 2.9 m). Snout moderately long and narrowly rounded or pointed; internarial width 1.1 to 1.4 times in preoral length; eyes circular and moderately large, their length 1.1 to 2.2% of total length; anterior nasal flaps low and poorly developed; upper labial furrows short and inconspicuous; hyomandibular line of pores just behind mouth corners not conspicuously enlarged; gill slits moderately long, the third 2.5 to 4.1% of total length and less than a half of first dorsal base; usually 15 to 16/15 rows of anteroposterior teeth in each jaw half but varying from 14 to 16/14 to 15; upper teeth with narrow, strongly serrated, semierect to oblique, high bent cusps, and crown feet with slightly coarser serrations but no cusplets; lower teeth with semierect, narrow serrated cusps and transverse roots. Usually no interdorsal ridge. First dorsal fin large and falcate, with pointed or narrowly rounded apex and posterior margin curving ventrally or posteroventrally from fin apex; origin of first dorsal fin over or slightly anterior to pectoral rear tips; inner margin of first dorsal moderately long, a third of dorsal base or less; second dorsal fin small and fairly low, its height 1.9 to 2.6% of total length, its inner margin short and 1.2 to 1.8 times its height; origin of second dorsal over or slightly posterior to anal origin; pectoral fins moderately large, falcate, with narrowly rounded or pointed apices, length of anterior margins about 16 to 21% of total length; 179 to 203 total vertebral centra, 96 to 110 precaudal centra. Colour bronzy to olive grey above, white below; most fins with inconspicuous darker edges and dusky to black tips, but fin markings not conspicuous; a moderately prominent white band on flank.



Geographical Distribution : Western Atlantic: Mexico, Gulf of Mexico, southern Brazil to Argentina. Eastern Atlantic: Mediterranean Sea, off France and Algeria, Morocco, Mauritania, Canary Islands, Guinea, Namibia to South Africa. Western Indian Ocean: South Africa. Western Pacific: Japan, the Koreas, China, southern Siberia; Australia (Queensland, New South Wales, Western Australia), New Zealand. Eastern Pacific: Southern California to Gulf of California; Peru.

Habitat and Biology : An inshore to offshore, warm-temperate shark, occurring from the surfline to at least 100 m depth. An active species, very common but with its biology poorly known because of confusion with other species. Apparently migratory in the northern parts of its range, moving northward in the spring and summetime and southward in autumn and winter.

Viviparous, with a yolk-sac placenta; number of young per litter 13 to 20. Sex ration 1:1 at birth. Off South Africa sexual maturity is said to occur at about 5 years old, with a maximum age of at least 12 years.

Eats a variety of bony fishes, including sardines, sea catfish, mullets, jacks, porgies, gurnards, hake, and sole, as well as spiny dogfish (Squalus), torpedo rays, sawfish, squid and cuttlefish. Off South Africa large numbers of these sharks follow sardine shoals along the southern Natal coast in winter. Considered a dangerous species, with a few provoked and unprovoked attacks on swimmers and divers ascribed to it; it is probably much less dangerous than the tiger and bull sharks because of its slender teeth and feeding habits.

Size : Maximum 292 cm, males maturing at 200 to 229 cm and reaching 266 cm, females maturing below 240 cm and reaching 292 cm; size at birth 59 to 67 cm.

Interest to Fisheries : Little is recorded on the use of this species but it is undoubtedly caught and used for human consumption where it occurs. It is taken in bottom trawls, by line gear, and by sports anglers.

Literature : Bigelow & Schroeder (1948); Garrick & Schultz (1963); Sadowsky (1967a); Garrick (1967a, 1982); Kato, Springer & Wagner (1967); Bass, D'Aubrey & Kistnasamy (1973); Applegate et al. (1979); Van der Elst (1981); Morenos & Hoyos (1983).

Remarks : Important vernacular names include 'bronze whaler' (Australia) and 'narrowtooth shark' (United States; Robins et al., 1980).

Carcharhinus brevipinna (Müller & Henle, 1839)

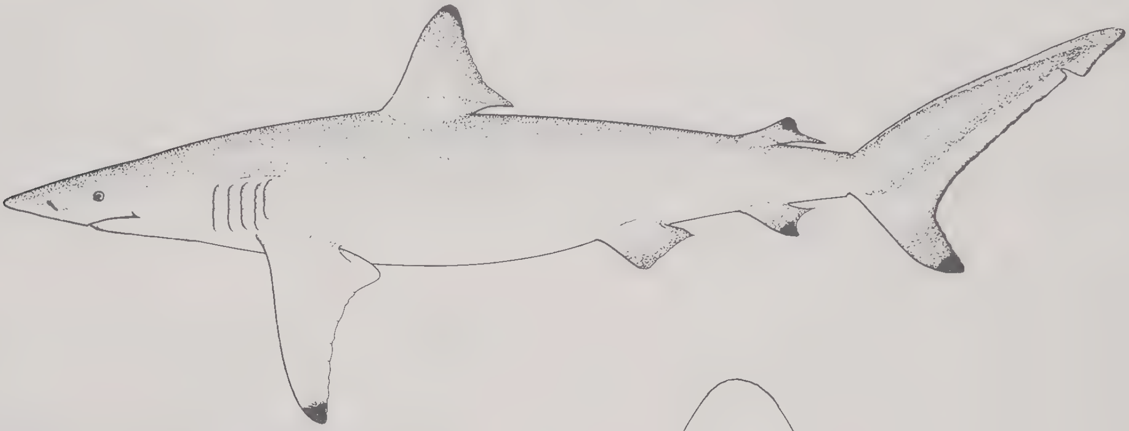
CARCH Carch 3

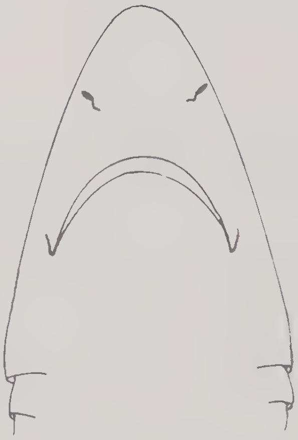
Carcharias (Aprion) brevipinna Müller & Henle, 1839, Syst.Beschr.Plagiost., (2):31, pl. 9. Holotype: Rijksmuseum van Natuurlijke Historie, RHN 2525, 785 mm mounted skin. Type Locality: Java.

Synonymy : Isogomphodon maculipinnis Poey, 1865; Uranga nasuta Whitley, 1943; Longmania calamaria Whitley, 1944; Aprionodon caparti Poll, 1951; Carcharhinus johnsoni Smith, 1951.

Other Scientific Names Recently in Use : Carcharhinus maculipinnis (Poey, 1865); Aprionodon brevipinna (Müller & Henle, 1839).

FAO Names : En - Spinner shark; Fr - Requin tisserand; Sp - Tiburón aleta negra.





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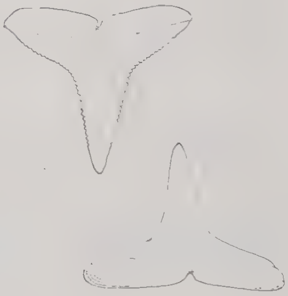
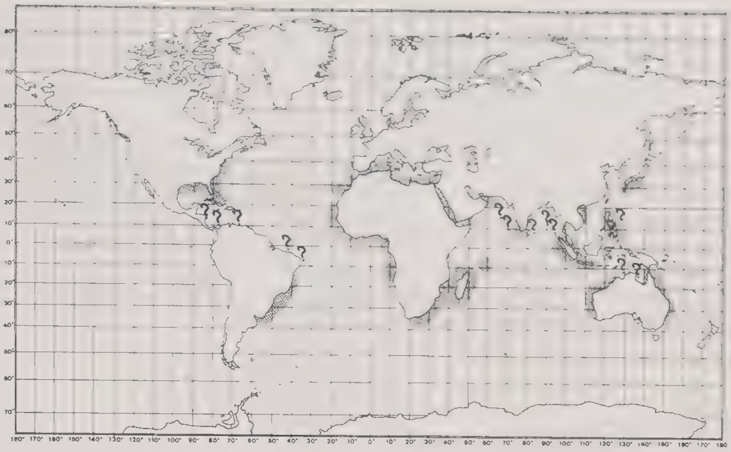


upper and lower tooth

Field Marks : A large fairly slender grey shark with a long pointed snout, small eyes, unusually long (for a grey shark) upper labial furrows, narrow, mostly erect- and narrow-cusped serrated or partly serrated upper anterolateral teeth without cusplets, long gill slits, lower teeth with narrow, smooth-edged cusps, usually 16/15-16 rows of anterolateral teeth, no interdorsal ridge, small pectoral fins, a small first dorsal with a short rear tip and a moderately large second dorsal with a short rear tip, and usually black tips on most fins in juveniles.

Diagnostic Features : A large, slender to slightly stocky species (up to about 2.8 m). Snout long and pointed or narrowly rounded; internarial width 1.5 to 1.8 times in preoral length; eyes circular and fairly small, 1.1 to 2% of total length; anterior nasal flaps relatively low and inconspicuous; upper labial furrows usually long and conspicuous, directed obliquely anterolaterally; hyomandibular line of pores just behind mouth corners not conspicuously enlarged; gill slits long, third 3.7 to 5.5% of total length; usually 16/15 rows of anteroposterior teeth in each jaw half but varying from 15 to 18/14 to 17; upper teeth with narrow, finely serrated, erect to slightly oblique, long cusps, and crown feet with fine serrations but no cusplets (serrations often irregular in young); lower teeth with erect, usually smooth-edged narrow cusps and transverse roots. No interdorsal ridge. First dorsal fin small and semifalcate, with pointed or narrowly rounded apex and posterior margin curving ventrally from apex; origin of first dorsal fin usually over or slightly posterior to pectoral free rear tip; inner margin of first dorsal short, a third of dorsal base or slightly less; second dorsal fin moderately large, its height 1.8 to 2.6% of total length, its inner margin short and 1.4 to 1.9 times its height; origin of second dorsal over or usually slightly behind anal fin origin; pectoral fins falcate, with narrow, pointed or narrowly rounded tips; relatively small, about 14 to 16% of total length in specimens above 100 cm and slightly smaller in young; 155 to 185 total vertebral centra, 84 to 96 precaudal centra. Young plain-finned but large juveniles to adults with black tips usually present on pectorals, second dorsal, anal and ventral caudal lobe, and sometimes on pelvics, first dorsal and dorsal caudal lobe. A white band on flanks, but often this is not conspicuous.



Geographical Distribution : Western Atlantic: Northern Carolina to Florida, Bahamas, Cuba, northern Gulf of Mexico, British Guiana, southern Brazil. Eastern Atlantic: Mediterranean, Cape Verde Islands, Senegal, Guinea and Sierra Leone, Togo and Nigeria, Angola. Indo-West Pacific: South Africa, Madagascar, Mauritius, Seychelles, Mozambique, Red Sea, Gulf of Aden, Oman, India, Singapore, Indonesia, (Java, Sumatra), Viet Nam, Japan, New Guinea, Australia (Queensland, New South Wales, Western Australia), possibly the Philippines.

Habitat and Biology : A common coastal-pelagic, warm-temperate and tropical shark of the continental and insular shelves, ranging close inshore and offshore; common in shallow waters at a depth less than 30 m, but ranging down to at least 75 m depth, from the surface to the bottom. The spinner shark is a schooling, active species like C. limbatus, but more commonly leaps spinning out of the water. Off Florida and Louisiana in the Gulf of Mexico, USA these sharks are highly migratory, moving inshore in spring and summer for reproduction and feeding, but possibly moving southward and into deeper water during the autumn and winter.

Viviparous, with a yolk-sac placenta; number of young 3 to 15, with larger females carrying more young. Off South Africa young are usually born in the autumn although some may be born in winter, after a gestation period of 12 to 15 months. Off Senegal young are born in summer while in the Gulf of Mexico off Florida and Louisiana young are born in spring to early summer. In the Gulf of Mexico adult sharks remain in shallow water during the summer but retreat possibly southward or into deeper water in the autumn. The Natal coast serves as a nursery ground for one population of this shark; adult females occur there throughout the year while males seasonally occur during the summer. Tagging studies in South African waters suggest that young sharks prefer slightly lower temperatures than adults, and tend to move south and Capeward from Natal when temperatures increase.

Primarily a fish-eater, the diet including ten-pounders (Elops), sardines and herring, anchovies, sea catfish, lizardfish, mullets, bluefish, tunas, bonito, croakers, jacks, mojarras, grunts, tongue-soles, stingrays, cuttlefish, squid and octopi. It frequently uses an unusual method of feeding on schools of small bony fishes that gives this shark its common name; it swims rapidly upward through the schools with open mouth, spinning along its long axis and snapping in all directions, and then shoots out of the water after its feeding run. Off Madagascar this species is associated with and probably feeds on migrating schools of scombrids and jacks. As with C. limbatus, this species will congregate to eat trash fish dumped off shrimp trawlers, and no doubt participates in feeding frenzies like its smaller relative.

In at least one instance this shark apparently attacked a bather; however, like its relative C. limbatus, it is probably not highly dangerous, but could be troublesome to divers when they are spearfishing. It has small, narrow-cusped teeth (smaller than in C. limbatus) that are clearly not adapted for feeding on large prey, and probably greatly prefers whole small fishes to mammalian prey.

Size : Maximum reported 278 cm, males maturing at 159 to 203 cm and reaching at least 233 cm, females maturing at 170 to 200 cm and reaching 278 cm; size at birth about 60 to 75 cm.

Interest to Fisheries : Apparently regularly caught in fisheries where found, with pelagic longlines, fixed bottom nets, and on hook-and-line; meat utilized fresh and dried salted for human consumption; also valuable for hides and fins, and for liver oil (vitamins).

Literature : Bigelow & Schroeder (1948); Poll (1951); Cadenat (1957); Fourmanoir (1961); Springer (1960, 1963); Garrick & Schultz (1963); Randall (1963); Gohar & Mazhar (1964); Clark & von Schmidt (1965); Bass, D'Aubrey & Kistnasamy (1973); Cadenat & Blache (1981); Garrick (1982); Branstetter (1982).

Remarks : This common and wide-ranging shark has often been confused with its somewhat smaller relative, C. limbatus, in the past, but in addition various growth stages of this shark in different areas has often been considered separate species. The coloration and tooth serrations of this shark change markedly with growth, and these changes have resulted in much confusion in the literature (see Garrick, 1982, for a discussion of the taxonomy and nomenclature of this species).

Bass, D'Aubrey & Kistnasamy (1973) and Garrick (1982) separated this species from C. limbatus by its smooth-edged lower teeth, longer, slenderer body, shorter smaller fins, more posterior first dorsal origin, and black-tipped anal fin (in sharks over 130 cm long, smaller with plain anal fins like C. limbatus at all sizes). Branstetter (1982) analysed the characters used to separate the two species and noted overlap in lower tooth serrations, first dorsal origin position, and eye size, but noted the species could be separated by the following characters: a lower first dorsal fin (height equal to preorbital space, versus much greater in C. limbatus; or height greater than 2.2 times in interdorsal space, versus about equal to or less than 2.2 times in interdorsal space), with a more rounded apex and vertical posterior margin (more pointed and falcate in C. limbatus) and its origin more posterior in adults (and probably large juveniles; over or behind the pectoral rear tips, versus about opposite the pectoral insertions in C. limbatus); a longer snout, with prenarial space 1.1 to 1.4 times distance from front of nostrils to mouth (0.7 to 1 in C. limbatus); higher tooth row counts with some overlap (usually 16 rows of upper anteroposterior teeth in C. brevipinna, usually 15 in C. limbatus, with the two respectively varying from 15 to 18 and 14 to 16 rows of these teeth); Meckel's cartilage without a posterior notch just below the mandibular joint (present in C. limbatus); and anal fin black-tipped (even in sharks a few months old in the Gulf of Mexico, but possibly not attained until a greater age and size in the western Indian Ocean). In sorting out piles of small sharks in the field in India, the writer found that the long diagonal upper labial furrows of this species were very useful in separating spinner sharks from other species, including C. limbatus, as was its slender body, long gill slits, long narrow snout, small fins and small teeth.

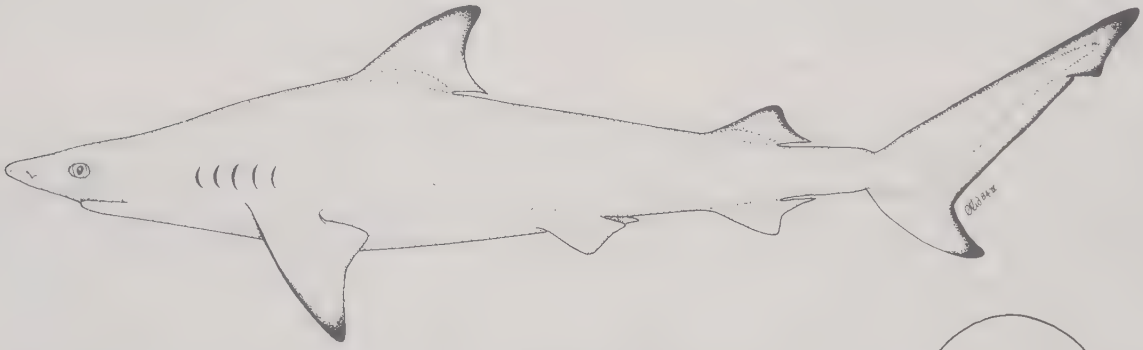
Carcharhinus cautus (Whitley, 1945)

CARCH Carch 28

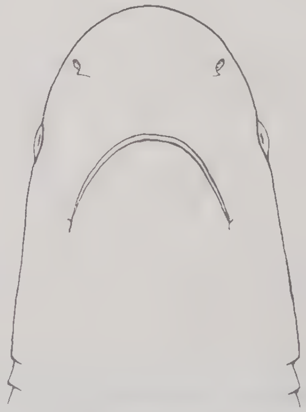
Galeolamna greyi cauta Whitley, 1945, Aust.Zool., 11(1):2, fig. 2. Holotype: Australian Museum, Sydney, IB. 1622, 918 mm female (skin and teeth only). Type Locality: Shark Bay, Herald Bight, Western Australia.

Synonymy : None.

FAO Names : En - Nervous shark; Fr - Requin nerveux; Sp - Tiburón nervioso.



Field Marks : A moderate-sized, greyish or brownish 'grey shark' with a short, bluntly rounded snout, horizontally oval eyes, anteroposterior tooth rows usually 12 to 13/12 to 13 in each jaw half, no interdorsal ridge, a moderately large second dorsal with a short rear tip, and black edges on the dorsal fins and caudal and black tips on the upper and lower caudal lobe and pectoral fin.



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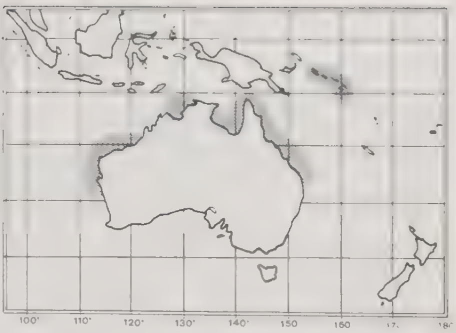
Diagnostic Features : A moderate-sized, fairly stocky species (to 1.5 m). Snout short and bluntly rounded; internarial width 1.1 to 1.2 times in preoral length; eyes horizontally oval and fairly large, their length 1.9 to 3.3% of total length; anterior nasal flaps moderately elongated and expanded as nipple-shaped lobes; upper labial furrows short and inconspicuous; hyomandibular line of pores just behind mouth corners not conspicuously enlarged; gill slits moderate-sized, the third 2.9 to 3.4% of total length and less than a third of first dorsal base; usually 12 to 13/12 to 13 rows of anteroposterior teeth in each jaw half but varying from 12 to 14/11 to 13; upper teeth with narrow, strongly serrated, oblique, moderately high cusps, and crown feet with coarser serrations and cusplets; lower teeth with erect to oblique, narrow serrated cusps and transverse roots. No interdorsal ridge. First dorsal fin large and falcate, with a narrowly rounded or pointed apex and posterior margin curving ventrally from fin apex; origin of first dorsal fin over or somewhat in front of pectoral free rear tips; inner margin of first dorsal short, less than a third of dorsal base; second dorsal fin large and high, its height 3.1 to 4.1% of total length, its inner margin short and 1 to 1.1 times its height; origin of second dorsal about over anal origin; pectoral fins moderately large, narrow and falcate, with narrowly rounded or pointed apices, length of anterior margins about 17 to 19% of total length; 160 to 171 total vertebral centra, 86 to 90 precaudal centra. Colour grey or light brown above, white below; dorsal, caudal and pectoral fins with black margins, expanded apically to black tips on caudal lobes and pectorals; probably a conspicuous white band on flank.



Geographical Distribution : Eastern Indian Ocean and western South Pacific: Australia (Queensland, western and northern Australia), Ugi and Solomon Islands.

Habitat and Biology : The nervous shark is a little-known South Pacific reef shark that may have a wider distribution. It apparently lives in shallow water on the continental and insular shelves, but may range in deeper water. According to Whitley (1940), they are rather skittish and timid when accosted by people, hence the name he bestowed on them. Presumably viviparous. Eats small fishes, including lizardfish and smelt-whiting (*Sillago*), and crabs. Probably harmless or minimally hazardous to people.

Size : Maximum about 150 cm, adult females 120 to 150 cm; size at birth between 35 and 39 cm.

Interest to Fisheries : Unknown.

Literature : Whitley (1940, 1945); Garrick (1982).

Remarks : This species is rather similar to the blacktipped reef shark, *Carcharhinus melanopterus*, but lacks the conspicuous highlighted black blotch on its first dorsal fin, and has lower vertebral counts.

Carcharhinus dussumieri (Valenciennes, 1839)

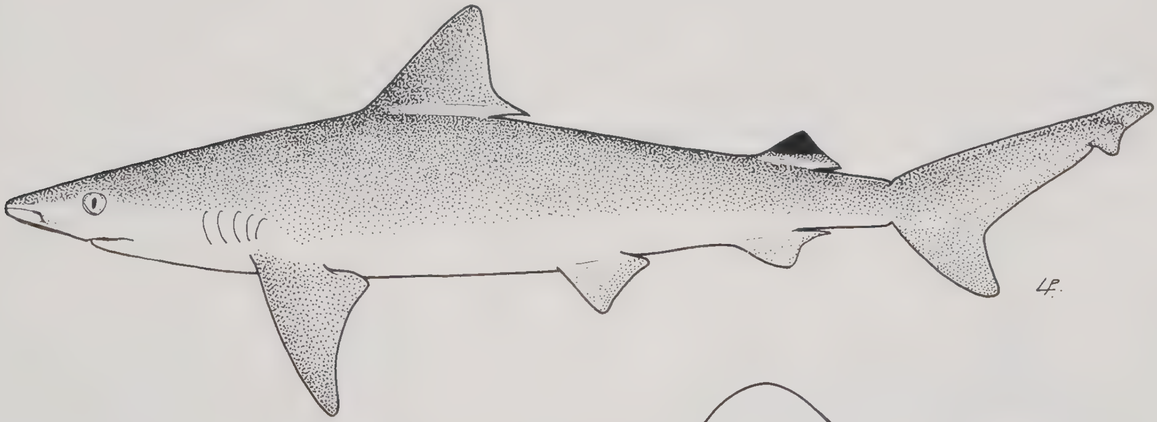
CARCH Carch 20

Carcharias (Prionodon) dussumieri Valenciennes, *in* Müller & Henle, 1839, *Syst.Beschr.Plagiost*, (2):47, pl. 19. Lectotype: Museum National d'Histoire Naturelle, Paris, MNHN 1135, 370 mm immature male, designated by Garrick (1982). Type Locality: Pondicherry, India.

Synonymy : *Carcharias (Prionodon) tjutjot* Bleeker, 1852; *Carcharias (Prionodon) javanicus* Bleeker, 1852; *Carcharias malabaricus* Day, 1873.

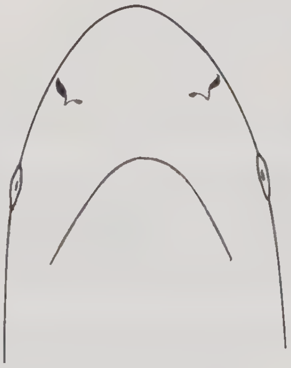
Other Scientific Names Recently in Use : *Carcharhinus menisorrah* (Valenciennes, *in* Müller & Henle, 1839) = *C. falciformis* (Bibron, *in* Müller & Henle, 1839) as restricted by Garrick (1982).

FAO Names : En - Whitecheek shark; Fr - Requin à joues blanches; Sp - Tiburón cariblanco.



Field Marks : A small grey shark with moderately long rounded snout, fairly large horizontally oval eyes, a black spot on the second dorsal fin but no other markings, oblique-cusped serrated teeth in both jaws, upper teeth with strong, serrated cusplets, usually 13/13 to 14 rows of anterolateral teeth, small semifalcate pectoral fins, a small triangular first dorsal with a short rear tip and a moderately large second dorsal with a short rear tip.

Diagnostic Features : A small, slender to slightly stocky species (up to about 1 m). Snout moderately long and moderately pointed or narrowly rounded; internarial width 1.1 to 1.6 times in preoral length; anterior nasal



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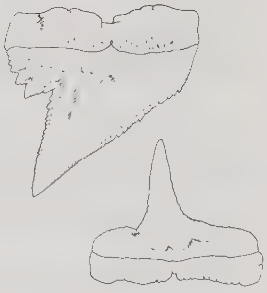
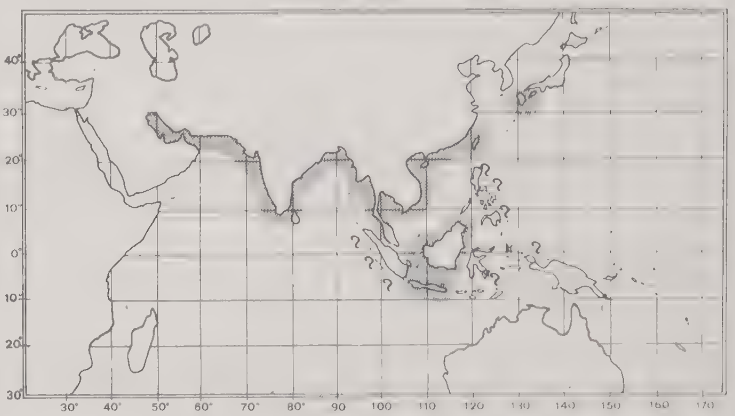


upper and lower tooth

flaps elongated and triangular; eyes usually horizontally oval, moderately large, their length 2 to 2.2% of total length in specimens over 50 cm long; upper labial furrows short and inconspicuous; hyomandibular line of pores just behind mouth corners not conspicuously enlarged; usually 13/13 to 14 rows of anteroposterior teeth in each jaw half but varying from 12 to 14/11 to 15; upper teeth with narrow to moderately broad, strongly serrated, strongly oblique cusps, and crown feet with strong, serrated, distal cusplets; lower teeth with oblique, narrow serrated cusps and transverse roots. Interdorsal ridge present. First dorsal fin small, broadly triangular, not strongly falcate, with pointed or narrowly rounded apex and posterior margin that slopes posteriorly from apex; origin of first dorsal fin over posterior half of pectoral inner margins; second dorsal fin large and high, its height 2.6 to 4% of total length, its inner margin short and 1 to 1.5 times its height; origin of second dorsal over or slightly behind anal fin origin; pectoral fins small, semifalcate, with narrow, angular apices, length of anterior margins about 15 to 17% of total length in large (over 60 cm) individuals; 109 to 150 total vertebral centra, 54 to 74 precaudal centra. Colour grey or grey brown; black or dusky tip present on second dorsal fin only, other fins with pale trailing edges; light stripe on flank not conspicuous.

Geographical Distribution : Indo-West Pacific: The "Gulf" and Arabian Sea between Gulf of Oman and Pakistan, India, Singapore, Malaysia, Java, Thailand, Borneo, Viet Nam, China, Japan.



Habitat and Biology : A small, very common, but little-known inshore shark of the continental and insular shelves, with its biology scantily known because of general confusion with its sibling species *C. sealei* under the name *C. menisorrah* (as restricted by Garrick, 1982, properly a synonym of *C. falciformis*).

Viviparous, with a yolk-sac placenta. Litter size normally 2 but exceptionally up to 4. Off northwestern Borneo and off Taiwan Island (Province of China), there is no apparent birth season, as gravid females with full-term young occur all year, but with a peak in July and August; most of the mature females caught off Borneo were gravid (Teshima & Misue, 1972).

A harmless species, probably feeding on small fishes, cephalopods and crustaceans.

Size : Maximum about 100 cm, males maturing at 65 to 70 cm and reaching at least 82 cm, females maturing at 70 to 75 cm and reaching at least 83 cm. Size at birth 37 to 38 cm.

Interest to Fisheries : This is a very common, small inshore shark where it occurs, that is readily available to artisanal and smallscale commercial fisheries and is commonly marketed for meat for human consumption.

Literature : Fowler (1941); Teshima & Misue (1972); Garrick (1982).

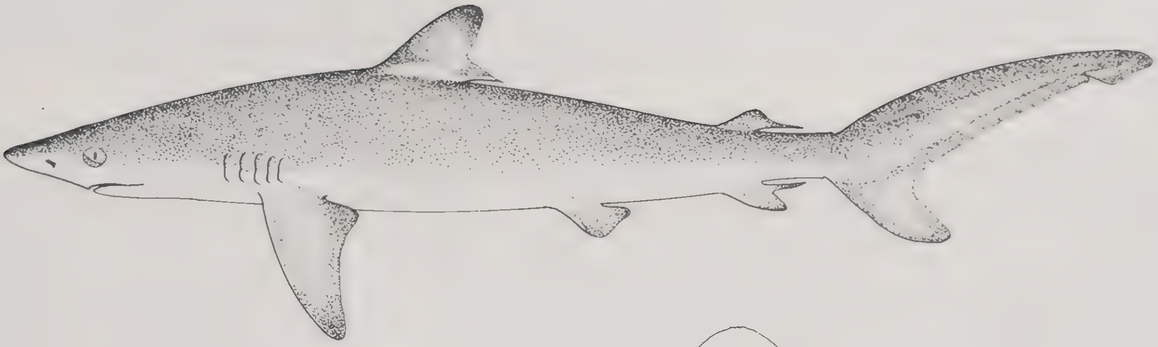
Carcharhinus falciformis (Bibron, 1839)

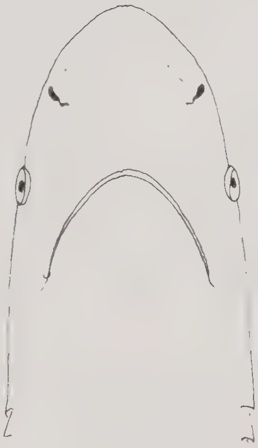
CARCH Carch 4

Carcharias (*Prionodon*) *falciformis* Bibron, *in* Müller & Henle, 1839, *Syst.Beschr.Plagiost.*, (2):47. Holotype: Museum National d'Histoire Naturelle, Paris, MNHN 1134, 528 mm female fetus. Type Locality: Cuba.

Synonymy : ? *Carcharias falcipinnis* Lower, 1839 (see Garrick, 1982); *Carcharias* (*Prionodon*) *menisorrah* Valenciennes, *in* Müller & Henle, 1839; *Squalus* or *Prionodon tiburo* Poey, 1860 (not *Squalus tiburo* Linnaeus, 1758 = *Sphyrna tiburo*; *Gymnorhinus* or *Gymnorrhinus pharaonis* Hemprich & Ehrenberg, 1899; *Aprionodon sitankaiensis* Herre, 1931; *Carcharhinus floridanus* Bigelow, Schroeder & Springer, 1943; *Eulamia malpeloensis* Fowler, 1944; *Carcharhinus atrodorsus* Deng, Xiong & Zhan, 1981.

FAO Names : En - Silky shark; Fr - Requin soyeux; Sp - Tiburón jaquetón.





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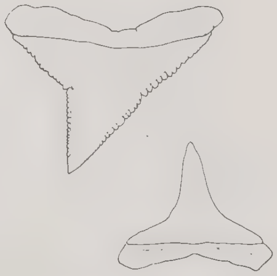
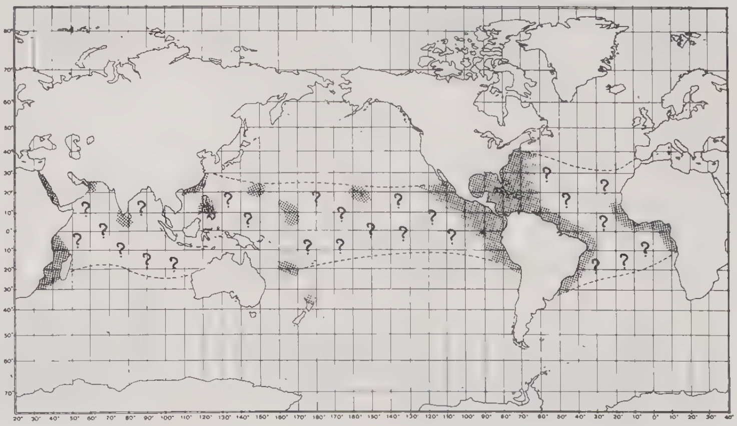


upper and lower tooth

Field Marks: A large, dark, slim, oceanic grey shark with moderately long rounded snout, moderately large eyes, oblique-cusped serrated teeth in the upper jaw, upper teeth with basal cusplets or very strong serrations, usually 15/15 rows of anteroposterior teeth, an interdorsal ridge, long narrow pectoral fins, a moderate-sized first dorsal with its origin behind the pectoral rear tips, a low second dorsal with a greatly elongated inner margin and rear tips, and no conspicuous markings.

Diagnostic Features: A large, fairly slender species (up to about 3.3 m). Snout moderately long and rounded; internarial width 1.2 to 1.6 times in preoral length; eyes circular and moderately large, their length 1.2 to 2.7% of total length; upper labial furrows short and inconspicuous; hyomandibular line of pores just behind mouth corners not conspicuously enlarged; gill slits moderate-sized, the third 2.9 to 3.6% of total length and less than 2/5 of first dorsal base; usually 15/15 rows of anteroposterior teeth in each jaw half but varying from 14 to 16/13 to 17; upper teeth with fairly narrow, strongly serrated, erect to moderately oblique cusps, well-delimited from crown feet, feet with heavy serrations or small cusplets; lower teeth with erect, narrow, smooth-edged cusps and transverse roots. A narrow interdorsal ridge present. First dorsal fin moderate-sized and falcate, with narrowly to broadly rounded apex and posterior margin curving ventrally from fin apex; origin of first dorsal fin behind pectoral free rear tips; inner margin of first dorsal long, about half dorsal base or slightly more or less; second dorsal fin very small and low, its height 1.3 to 2.2% of total length, its inner margin long and 1.6 to 3 (usually over 2) times its height; origin of second dorsal over or slightly behind anal origin; pectoral fins large (especially in adults, shorter in young), narrowly falcate, with narrowly rounded or pointed apices, length of anterior margins about 14 to 22% of total length; 199 to 215 total vertebral centra, 98 to 106 precaudal centra. Colour dark grey or grey brown above, sometimes nearly blackish, white below; tips of fins other than first dorsal dusky but not black-tipped; an inconspicuous white band on flank.

Geographical Distribution: Oceanic and coastal, circumtropical. Western Atlantic: Massachusetts to southern Brazil, including Gulf of Mexico and Caribbean Sea: Central Atlantic from St. Paul's Rocks. Eastern Atlantic: Madeira, Atlantic Spain, Senegal to northern Angola. Indian Ocean: Madagascar, Mozambique, Tanzania, Comores and Aldabra Island, between Somalia and Maldive Islands, Oman, Red Sea, Sri Lanka. Western Pacific: Thailand, the Philippines, New Caledonia, New Zealand and China (including Taiwan Island). Central and eastern Pacific: Caroline, Hawaiian, Phoenix and Line Islands, westward to Cocos, Revillagigedo, Clipperton and Malpelos Islands, southern Baja California to Peru.



Habitat and Biology: An abundant offshore, oceanic and epipelagic and littoral, tropical shark, found near the edge of continental and insular shelves but also far from land in the open sea. It occasionally occurs inshore where the water is as shallow as 18 m; in the open ocean it occurs from the surface down to at least 500 m depth.

The silky shark is often found over deepwater reefs and near insular slopes. Water temperatures of 23° to $24^{\circ}C$ have been recorded where it occurs. It is an active, quick-moving, aggressive shark in the water, but defers to the more sluggish but stubbornly persistant oceanic whitetip shark. When approached by divers individuals have been seen to perform a "hunch" display, with back arched, head raised and caudal fin lowered, possibly as a defensive threat display.

Population dynamics and structure are poorly known. Longline sampling in the eastern and central Pacific shows this shark to be much more abundant offshore near land than in the open ocean, unlike the blue shark (Prionace glauca) and the oceanic whitetipe shark (Carcharhinus longimanus), which occur with it. One is tempted to speculate that this shark is perhaps less well-adapted to oceanic life than the whitetip and blue sharks, and that its greater activity is best supported in offshore areas close to land masses that have higher productivity of prey species than the open ocean. The sluggishness, opportunistic feeding habits, and long pectoral fins of the blue and whitetip sharks may be energy-saving adaptations for life in the open sea; the blue shark additionally has gillraker papillae that apparently adapt it to preying on small pelagic animals. Sketchy data shows no strong tendency for sexual segregation in the silky shark, but this may very well occur. There is size segregation, with young occurring on offshore nursery areas and adults seaward from them. This is one of the three most common oceanic sharks, along with the blue and oceanic whitetip sharks, and one of the more abundant large marine organisms.

Viviparous, with a yolk-sac placenta; number of young 2 to 14 per litter. There seems to be no pronounced seasonality in birth of young. The gestation period is not known. In the western North Atlantic nursery areas for the young of this shark occur along the outer edge of the continental shelf and on oceanic banks in the Caribbean.

Primarily a fish-eater, eating pelagic and inshore teleosts including sea catfish, mullets, mackerel, yellowfin tuna, albacore, and porcupine fish, but also squid, paper nautiluses, and pelagic crabs. Associated with schools of tuna, and earning the ire of tuna purse seiners for the damage it does to nets and catches; it is called the 'net-eater shark' in the tropical eastern Pacific.

The silky shark is generally regarded as dangerous or potentially dangerous to people, particularly because of its size and abundance offshore, although no attacks have been attributed to it. Because of its lesser aggressiveness and apparently more restricted diet, it may very well be less dangerous than the oceanic whitetip shark.

Size : Maximum about 330 cm, males maturing at about 187 to 217 cm and reaching 270 to 300 cm; females maturing at 213 to 230 cm and reaching at least 305 cm; size at birth about 70 to 87 cm.

A length-weight curve for Cuban sharks is:

$$WT = 0.8782 \times 10^{-5} \text{ total length}^{3.091} \text{ (Guitart Manday, 1975).}$$

Interest to Fisheries : This species is very commonly taken by pelagic longline fisheries but is also taken in fixed bottom nets. Important fisheries exist in the Gulf of Mexico and Caribbean Sea, but probably also elsewhere. Its meat is utilized fresh and dried salted for human consumption; its hide for leather; its fins for shark-fin soup; and its liver is extracted for oil, which has high vitamin A content.

Literature : Bigelow & Schroeder (1948); Cadenat (1957); Rosenblatt & Baldwin (1958); Springer (1960, 1967); Fourmanoir (1961); Garrick & Schultz (1963); Garrick, Backus & Gibbs (1964); Kato (1964); Gilbert & Schlernitzauer (1965); Bane (1966); Kato & Carvallo (1967); Garrick (1967, 1982); Kato, Springer & Wagner (1967); Bass, D'Aubrey & Kistnasamy (1973); Guitart Manday (1975); Compagno & Vergara (1978); Cadenat & Blache (1981); Compagno (1981a).

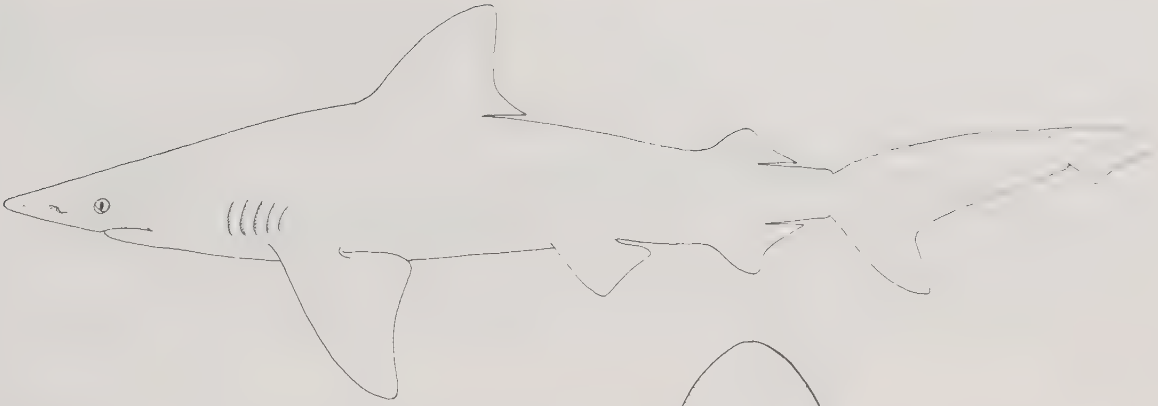
Carcharhinus fitzroyensis (Whitley, 1943)

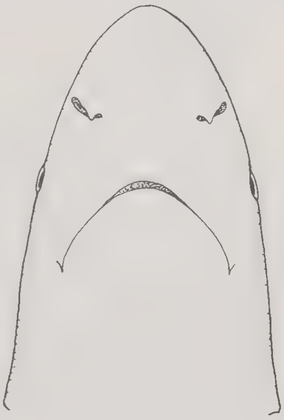
CARCH Carch 29

Galeolamna (Uranganops) fitzroyensis Whitley, 1943, Proc.Linn.Soc.N.S.W., 68(1):117, fig. 2. Holotype: Australian Museum, Sydney, AMS IB. 1229, 1174 mm female. Type Locality: Fitzroy River Estuary, Connor's Creek, Queensland, Australia.

Synonymy : None.

FAO Names : En - Creek whaler; Fr - Requin baleinier; Sp - Tiburón ballenero.





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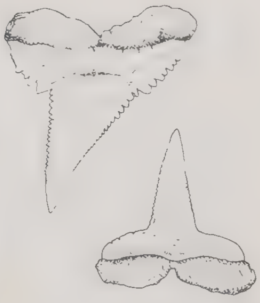
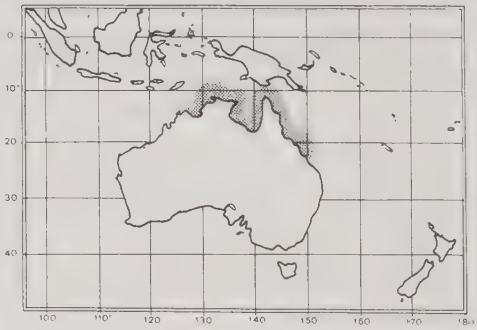


upper and lower tooth

Field Marks : A moderately large, broad- and triangular-finned grey shark with short labial furrows, lobate anterior nasal flaps, short gill slits, 14/13 to 14 rows of anteroposterior teeth in each jaw half, somewhat oblique, narrow cusped, upper teeth with serrations and basal cusplets, no interdorsal ridges, moderately large second dorsal fin with origin about over anal origin, and no conspicuous markings.

Diagnostic Features : A fairly stocky species (up to about 1.5 m). Snout long and parabolic; internarial width 1.7 to 1.8 times in preoral length; eyes circular and moderately large, their length about 1.4% of total length; anterior nasal flaps moderately low and produced as a nipple-like lobe; upper labial furrows short and inconspicuous; hyomandibular line of pores just behind mouth corners not conspicuously enlarged; gill slits short, third 3% of total length and less than a third of first dorsal base; usually 14/13 to 14 rows of anteroposterior teeth in each jaw half; upper teeth with narrow, strongly serrated, semierect and oblique, high cusps, and crown feet with coarse serrations and small cusplets; lower teeth with erect, narrow, partly serrated cusps and transverse roots. No interdorsal ridge. First dorsal fin large and semifalcate, with a pointed or narrowly rounded apex and posterior margin curving ventrally from fin apex; origin of first dorsal fin over or somewhat anterior to pectoral free rear tips; inner margin of first dorsal short, a third of dorsal base or somewhat more; second dorsal fin large and high, its height 3.2% of total length, its inner margin short and 1.5 times its height; origin of second dorsal over or slightly behind anal origin; pectoral fins moderately large, triangular, with narrowly rounded apices, length of anterior margins about of 17 to 19% of total length; 125 total vertebral centra, 58 precaudal centra. Colour grey above, light below, without conspicuous markings on fins; no conspicuous white band on flanks.



Geographical Distribution : Western Pacific: Australia (Queensland, northern and northwestern Australia).

Habitat and Biology : A little-known tropical shark of the Australian littoral, found inshore and offshore on the continental shelves.

Size : Maximum probably not exceeding 150 cm, largest known specimen the holotype.

Interest to Fisheries : Apparently taken in some numbers by Taiwanese fishermen off Australia, and used for human consumption and probably for the oriental sharkfin trade.

Literature : Garrick (1982); J.D. Stevens (pers. comm.).

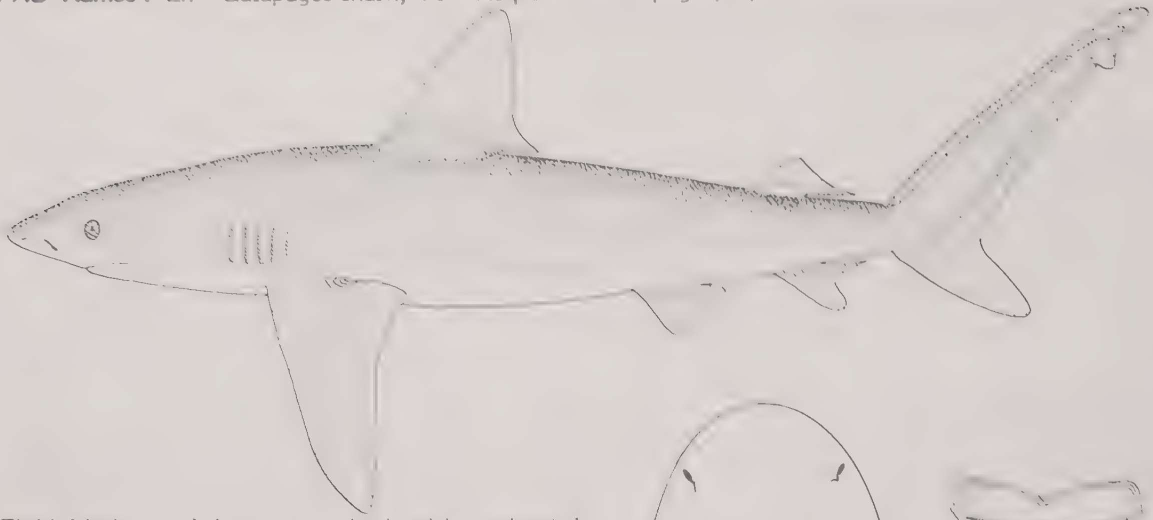
Carcharhinus galapagensis (Snodgrass & Heller, 1905)

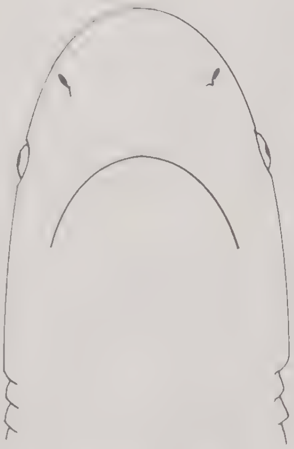
CARCH Carch 16

Carcharias galapagensis Snodgrass & Heller, 1905, Proc.Washington Acad.Sci., 6:343. Holotype: Stanford University Natural History Museum, SU 12324, 650 mm fetus, apparently lost. Type Locality: Galapagos Islands.

Synonymy : None.

FAO Names : En - Galapagos shark; Fr - Requin des Galapagos; Sp - Tiburón de Galápagos.





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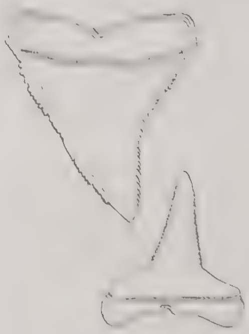
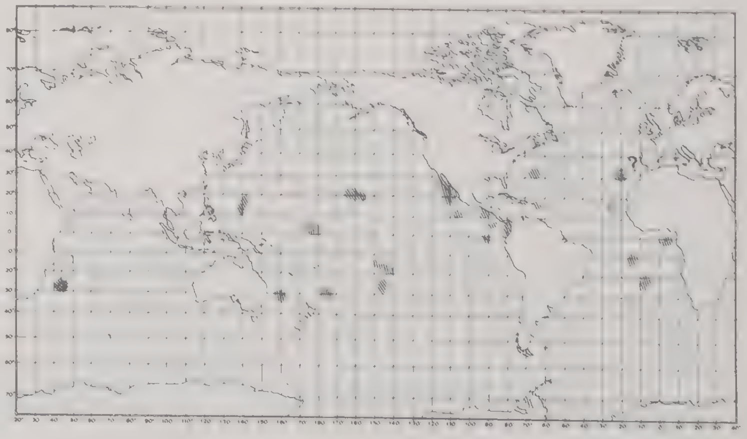


upper and lower tooth

Field Marks : A large grey shark with moderately long broadly rounded snout, low anterior nasal flaps, fairly large eyes, broad, triangular, high, erect and semioblique-cusped serrated anterolateral teeth without cusplets in upper jaw, lower teeth erect and narrow-cusped, usually 14/14 rows of anteroposterior teeth, a low interdorsal ridge, large, semifalcate pectoral fins, a moderately large first dorsal with a short rear tip and origin about opposite midlengths of pectoral fins and no conspicuous markings on fins.

Diagnostic Features : A very large, fairly slender species (up to between 3 and 4 m). Snout moderately long and broadly rounded; internarial width 1 to 1.3 times in preoral length; eyes circular and moderately large, their length 1.3 to 2.4% of total length; anterior nasal flaps low and poorly developed; upper labial furrows short and inconspicuous; hyomandibular line of pores just behind mouth corners not conspicuously enlarged; gill slits moderately long, third 2.7 to 4% of total length and less than a third of first dorsal base; usually 14/14 rows of anteroposterior teeth in each jaw half but varying from 13 to 15/13 to 15; upper teeth with broad, triangular, strongly serrated, fairly high erect to slightly oblique cusps that smoothly merge into crown feet, which have slightly coarser serrations but no cusplets; lower teeth with erect, moderately broad, serrated cusps and transverse or slightly arched roots. A low interdorsal ridge present. First dorsal fin moderately large and falcate, with pointed or narrowly rounded apex and posterior margin curving ventrally or anteroventrolaterally from fin apex; origin of first dorsal fin over midlengths of pectoral inner margins; inner margin of first dorsal moderately short, 2/5 of dorsal base or less; second dorsal fin moderately high, its height 2.6 to 2.8% of total length, inner margin fairly short and 1.3 to 1.7 times its height; origin of second dorsal about over anal origin; pectoral fins large and semifalcate, with narrowly rounded or pointed apices, length of anterior margins about 18 to 23% of total length; 200 to 215 total vertebral centra, 103 to 109 precaudal centra. Colour brownish-grey above, white below; tips of most fins dusky but not black or white; an inconspicuous white band on flank.

Geographical Distribution : Circumtropical but generally associated with oceanic islands. Western North Atlantic: Bermuda, Virgin Islands. Central and eastern Atlantic: Madeira, possibly off Spain or Portugal, Cape Verde, Ascension, St. Helena and Sao Thome Islands. Southwestern Indian Ocean: Walter's Shoal, south of Madagascar. Western central Pacific: Middleton & Elizabeth Reefs (off eastern coast of Australia), Lord Howe Island, Marianas, Marshall, Kermadec, and Tubai Islands (Rapa), Tuamotu Archipelago (Pitcairn and Ducie Islands), Hawaiian group (Hawaiian and low islands, including Laysan and Pearl & Hermes Reefs). Eastern Pacific: Galapagos, Cocos, Revillagigedo, Clipperton, and Malpelo Islands, also coasts of southern Baja California, Guatemala and Colombia.



Habitat and Biology : A common but habitat-limited tropical shark that occurs close inshore to well offshore near or on the insular or continental shelves; occurs in water 2 m deep but ranges to the open ocean adjacent to islands, from the surface to at least 180 m. Not oceanic but coastal pelagic and capable of crossing considerable distances of open ocean between islands (at least 50 km). Although occurring off the coasts of continental land masses in a few places (mostly in the tropical eastern Pacific, but possibly also Spain in the eastern Atlantic), this shark is mostly known from around islands, where it can be the most abundant of local sharks. Juveniles seem to be restricted to shallower water, in 25 m or less, which they apparently use as nursery grounds, while the adults range well offshore. This shark seems to favour clear water and rugged coral and rocky bottoms, and often swims a few metres above the substrate, but will come readily to the surface to feed or investigate disturbances. They are found in aggregations but apparently do not form coordinated schools. They are aggressive but at equal sizes defer to the silvertip shark, C. albimarginatus while being dominant to the blacktip shark, C. limbatus. Galapagos sharks perform a "hunch" display, with arched back, raised head, and lowered caudal and pectoral fins, while swimming in a conspicuous twisting, rolling motion, like the grey reef shark (C. amblyrhynchos); this is interpreted as a threat display, liable to be followed by an attack.

Viviparous, with a yolk-sac placenta; number of young 6 to 16 in Hawaiian waters.

Feeds primarily on bottom fishes, including eels, sea bass, flatfish, flatheads, and triggerfish, but also flyingfish, squid, octopi, and occasional garbage. Fresh baits presented to these sharks suggests that they definitely prefer fish to crab, mollusc and bird meat; they may be repelled by decayed shark and fish. Definitely known to be dangerous to people, as one was positively identified as the perpetrator of a fatal attack on a swimmer in the Virgin Islands, and possibly another was responsible for a nonfatal attack on a swimmer off Bermuda. In waters where they are abundant they often closely attend divers, and may show attraction to their swimfins and hands. Off Clipperton Island in the eastern Pacific, Limbaugh (1963) found small Galapagos sharks very abundant and aggressive, and a hindrance to diving operations. Continued diving activities tended to excite the sharks further, so that these had to be suspended. Aggressive actions by divers had a minimal deterring effect to sharks, but startled sharks would circle back and bring other excited sharks in their wake. Fish collecting by rotenone and blasting brought in numerous sharks, which went into a feeding frenzy. With many sharks, feeding stimuli, and social facilitation, the chances of an attack occurring are considerable, and the presence of large numbers of aggressive Galapagos sharks should be good reason to limit diving activity or to use passive protective gear such as shark cages, small submersibles, or anti-shark armor. Use of anti-shark weapons such as powerheads under such circumstances could further arouse uninjured sharks, and might start a feeding frenzy that could lead to attacks.

Size : Maximum possibly 370 cm, males maturing between 170 and 236 cm, adult males up to at leat 292 cm, females maturing at about 235 cm, reaching over 300 cm; size at birth 57 to 80 cm.

Interest to Fisheries : No information on utilization or fishing methods for this shark are available, but likely to figure in shark fisheries where it occurs because of its abundance in habitats it prefers.

Literature : Beebe & Tee-Van (1941); Rosenblatt & Baldwin (1958); Garrick & Schultz (1963); Limbaugh (1963); Kato (1964); Kato, Springer & Wagner (1967); Garrick (1967, 1982); Bass, D'Aubrey & Kistnasamy (1973); Myrberg & Gruber (1974); Edwards & Lubbock (1982).

Remarks : This shark closely resembles the largely allopatric dusky shark, Carcharhinus obscurus, but differs in having usually taller dorsal fins (first dorsal height 9.1 to 12.1% of total length, versus 5.8 to 9.9% of total length in C. obscurus; second dorsal height 2.1 to 3.3% of total length, versus 1.5 to 2.3 in C. obscurus; and second dorsal inner margin 1.3 to 1.7 times second dorsal height, versus 1.6 to 2.1 in C. obscurus), less falcate pectoral fins, a slightly more anterior first dorsal fin (usually over midlengths of pectoral inner margins, versus usually over their free rear tips in C. obscurus), higher upper anterolateral teeth, and more vertebral centra (86 to 97 precaudals and 173 to 194 total centra). Bass, D'Aubrey & Kistnasamy (1973) give a "discriminant function" for separating the two species, here modified as DF = (607 D1H + 2308 D2H + 875 ANH - 353 IDS)/TOT, where DF = discriminant function, D1H = first dorsal height, D2H = second dorsal height, ANH = anal height, IDS = interdorsal space, TOT = total length. Values of this function were calculated as 80 to 110 for this species but 32 to 67 for C. obscurus.

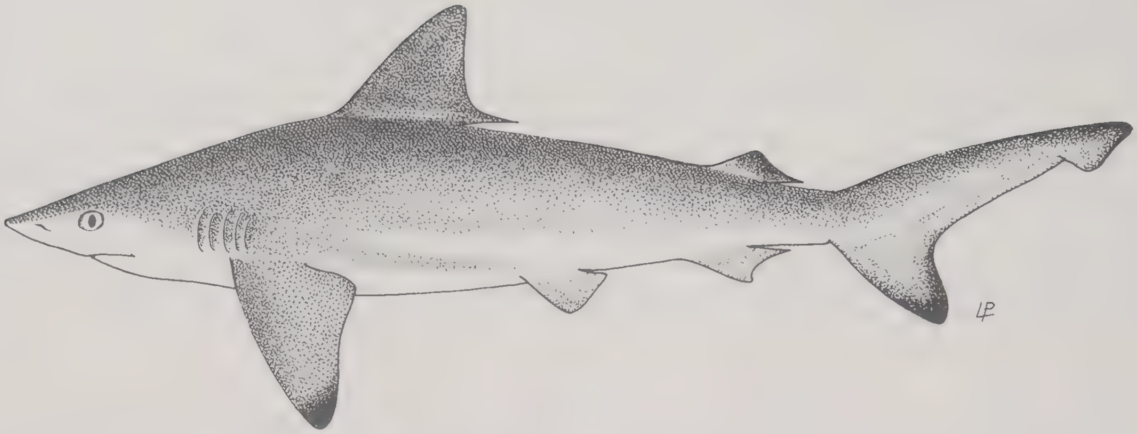
Carcharhinus hemiodon (Valenciennes, 1839)

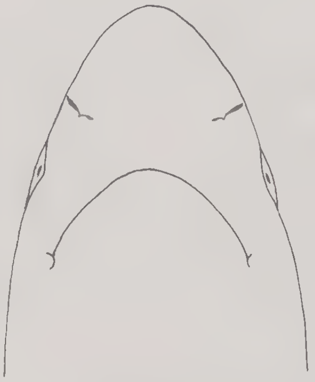
CARCH Carch 21

Carcharias (Hypoprion) hemiodon Valenciennes, in Müller & Henle, 1839, Syst.Beschr.Plagiost., (2): 35, pl. 19 (teeth only). Holotype: Museum National d'Histoire Naturelle, Paris, MNHN 1040, 470 mm immature male. Type Locality: Pondicherry, India.

Synonymy : ? Carcharias watu Setna & Sarangdhar, 1946 (see Garrick, 1982); ? Hypoprion atripinna Chu, 1960.

FAO Names : En - Pondicherry shark; Fr - Requin baliai; Sp - Tiburón de Pondicherry.





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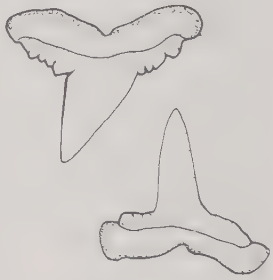
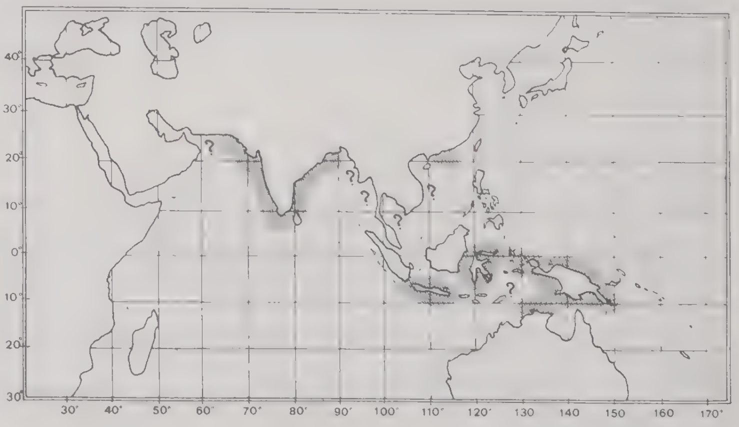


upper and lower tooth

Field Marks: A small (?) grey shark with moderately long and narrowly rounded or pointed snout, fairly large eyes, oblique-cusped weakly serrated upper anterolateral teeth with strong cusplets, 14 to 15/13 to 14 rows of anteroposterior teeth, an interdorsal ridge, small pectoral fins, a fairly large first dorsal with a short rear tip and a moderately large second dorsal with a short rear tip, and black markings on the pectorals, second dorsal, dorsal and ventral caudal lobes.

Diagnostic Features: A fairly stocky and possibly small species (known specimens less than 1 m). Snout moderately long and moderately pointed; internarial width 1 to 1.4 times in preoral length; eyes circular and moderately large, their length between 2 and 3% of total length; anterior nasal flaps expanded as narrow, nipple-shaped lobes; upper labial furrows short and inconspicuous; hyomandibular line of pores just behind mouth corners not conspicuously enlarged; gill slits short, the third 3.1 to 3.6% of total length and less than a third of first dorsal base; 14 to 15/13 to 14 rows of anteroposterior teeth in each jaw half; upper teeth with narrow, weakly and partially serrated, oblique, high cusps, and crown feet with strong distal cusplets; lower teeth with semierect, narrow smooth cusps and transverse roots. An interdorsal ridge present. First dorsal fin large and falcate, with pointed or narrowly rounded apex and posterior margin curving ventrally from fin apex; origin of first dorsal fin over pectoral inner margins just behind their insertions; inner margin of first dorsal moderately long, half of dorsal base or less; second dorsal fin fairly large and high, its height 2.7% of total length, its inner margin short and 1.4 to 1.6 times its height; origin of second dorsal over or slightly posterior to anal origin; pectoral fins moderately large, falcate, with narrowly rounded or pointed apices, length of anterior margins about 17 to 18% of total length; 154 total vertebral centra. Colour grey above, white below; fairly conspicuous (in fresh specimens, less so in old preserved material) black tips present on pectorals, second dorsal, and dorsal and ventral caudal lobes; a conspicuous white band on flank.



Geographical Distribution: Indo-West Pacific: Nominal from Oman to Viet Nam, Indonesia (Sulawesi, Java, Waigeo), New Guinea, and northern Australia, but uncertain beyond India, Pakistan and China.

Habitat and Biology: A little-known, wide-ranging, possibly common grey shark of the continental and insular shelves of the Indo-West Pacific. This species has been reported from river mouths and fresh water up rivers, including the Hooghly River in India and the Saigon River in Viet Nam, but these old records require confirmation and might have been based on some other species. Almost nothing is known of the biology of this shark.

Size: Maximum uncertain, probably not over 1.5 to 2 m.

Interest to Fisheries : A poorly known species apparently fished regularly in the waters of the Arabian Sea off Pakistan, India and possibly China.

Literature : Müller & Henle (1839); Day (1878); Garman (1913); Fowler (1941); Compagno (1979); J.A.F. Garrick (pers comm.).

Remarks : Judging from its description and illustration in Chu et al. (1962), Hypoprion atripinna is a probable junior synonym of this species, and is tentatively placed here. This species has sometimes been confused with other species. Day (1878, pl. 184, fig. 2) illustrated it as Carcharias limbatus, but its identity as C. hemiodon was confirmed by examining the illustrated specimen in the Zoological Survey of India, Calcutta.

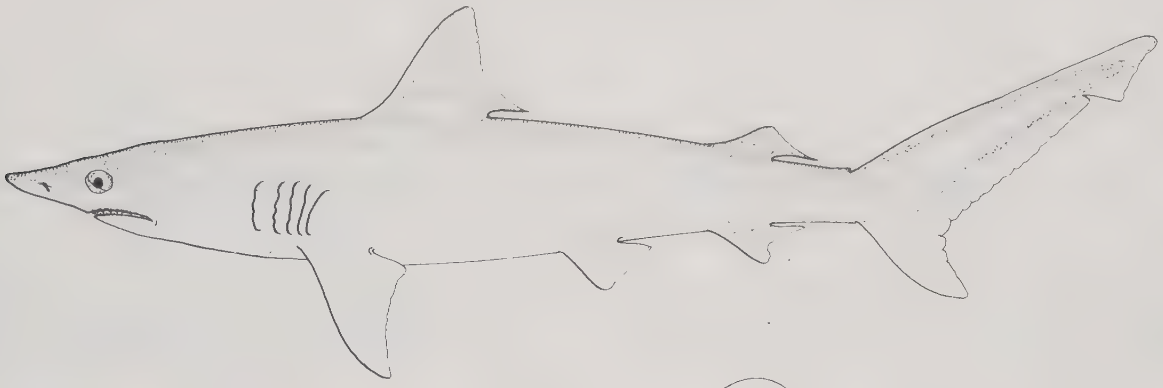
Carcharhinus isodon (Valenciennes, 1839)

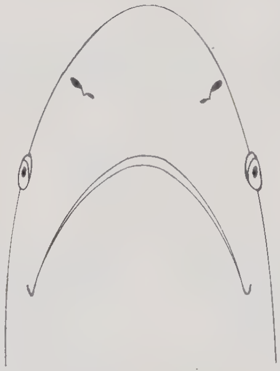
CARCH Carch 5

Carcharias (Aprion) isodon Valenciennes, in Müller & Henle, 1839, Syst.Beschr.Plagiost., (2):32. Holotype: Museum National d'Histoire Naturelle, MNHN 1037, 650 mm immature male. Type Locality: Probably coast of New York, USA.

Synonymy : Aprionodon punctatus Gill, 1861, 1862, 1864.

FAO Names : En - Finetooth shark; Fr - Requin à petites dents; Sp - Tiburón dentiliso.





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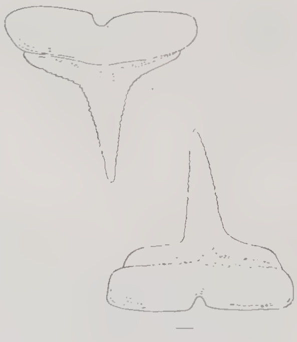
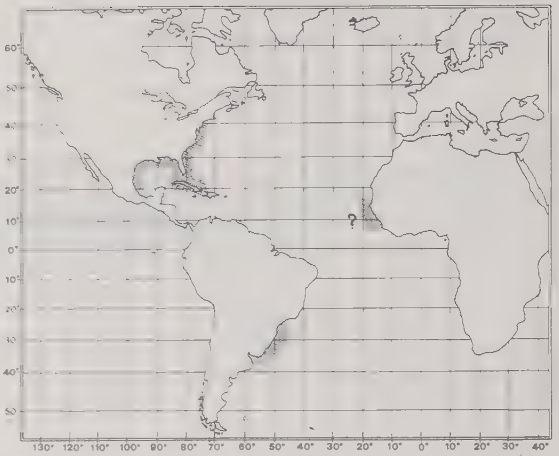


upper and lower tooth

Field Marks : A small grey shark with moderately long pointed snout, fairly large eyes, snout tip, very long gill slits about half length of dorsal base, erect-cusped smooth or irregularly serrated teeth in both jaws, upper teeth without cusplets, 12 to 15/13 to 14 rows of anterolateral teeth, no interdorsal ridge, small pectoral fins, a small first dorsal with a short rear tip and a moderately large second dorsal with a short rear tip, and no prominent markings on fins.

Diagnostic Features : A fairly slim species (up to about 2 m, but most smaller). Snout fairly long and moderately pointed; internarial width 1.3 times in preoral length; eyes circular and moderately large, their length 1.8 to 1.9% of total length; anterior nasal flaps low and broadly angular, not expanded; upper labial furrows short and inconspicuous; hyomandibular line of pores just behind mouth corners not conspicuously enlarged; gill slits very long, the third 4.8 to 5.7% of total length and about half of first dorsal base; 12 to 15/13 to 14 rows of anteroposterior teeth in each jaw half; upper teeth with narrow, weakly serrated or smooth, erect to slightly oblique cusps, and crown feet with weak serrations or none and no cusplets; lower teeth with erect, smooth cusps and transverse roots. No interdorsal ridge. First dorsal fin large and somewhat falcate, with a pointed or narrowly rounded apex and posterior margin curving ventrally from fin apex; origin of first dorsal fin over or only slightly posterior to pectoral insertions; inner margin of first dorsal moderately short, about a third of dorsal base; second dorsal fin large and high, its height 2.8 to 2.9% of total length, its inner margin short and 1.4 times its height; origin of second dorsal over or slightly posterior to anal origin; pectoral fins small, falcate, with narrowly rounded or pointed apices, length of anterior margins about 13% of total length in small individuals; 163 to 166 total vertebral centra, 77 to 81 precaudal centra. Colour plain, dark grey above, white below; no conspicuous markings on fins; an inconspicuous white band on flank.



Geographical Distribution : Western Atlantic: North Carolina and exceptionally New York to Florida, Cuba, Gulf of Mexico; southern Brazil. ? Eastern Atlantic: Senegal and Guinea-Bissau.

Habitat and Biology : A little-known grey shark of the tropical Atlantic, generally present close inshore. Thought to move northward along the east coast of the USA in summer. Forms large schools. Viviparous, with a yolk-sac placenta; number of young 1 to 6 per litter. Probably a predator on small bony fishes and cephalopods.

Size : Maximum about 189 cm and possibly to 200 cm, males maturing at about 140 cm and reaching at least 158 cm, females maturing at about 150 cm and reaching at least 165 cm; size at birth 51 to 64 cm.

Interest to Fisheries : In the western Atlantic caught incidentally throughout its range but relatively unimportant; caught with floating longlines inshore and presumably eaten fresh and dried salted.

Literature : Bigelow & Schroeder (1948); Baughman & Springer (1950); Clark & von Schmidt (1965); Compagno & Vergara (1978); Cadenat & Blache (1981).

Remarks : Old records of this species from tropical West Africa have not been confirmed, and it is possible that these were based on some other species, particularly C. brevipinna.

Carcharhinus leucas (Valenciennes, 1839)

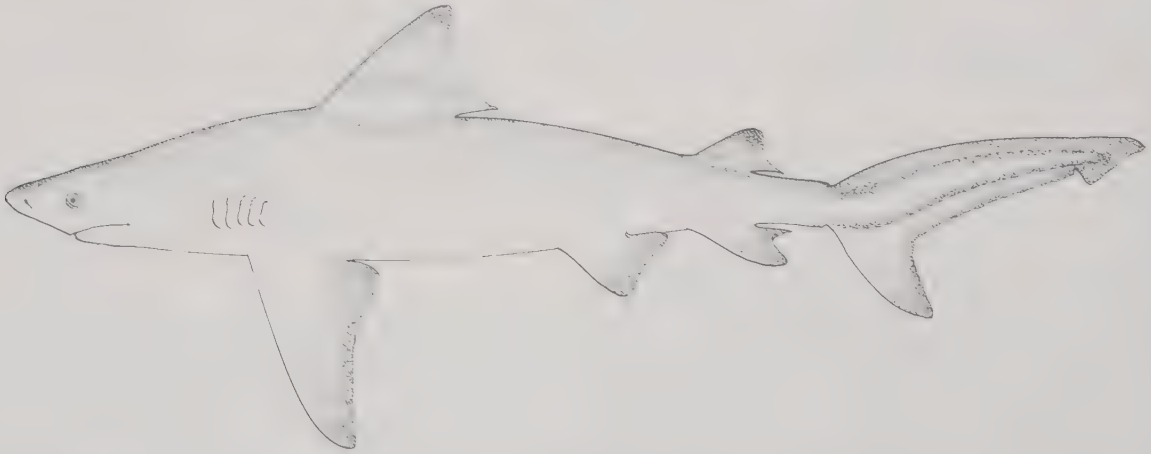
CARCH Carch 6

Carcharias (Prionodon) leucas Valenciennes, in Müller & Henle, 1839, Syst.Beschr.Plagiost., (2):42. Syntypes: Of four syntypes in the Museum National d'Histoire Naturelle, Paris, two stuffed specimens are still in existence: MNHN A9650, 1600 mm adult male, and MNHN A9652, 1860 mm female. Type Locality: Antilles.

Synonymy : Carcharias (Prionodon) zambezensis Peters, 1852; Squalus platyodon Poey, 1861; Squalus obtusus Poey, 1861; Eulamia nicaraguensis Gill & Bransford, 1877; Carcharias azureus Gilbert & Starks, 1904; Carcharias spenceri Ogilby, 1911; Galeolamna (Bogimba) bogimba Whitley, 1943; Galeolamna greyi mckaili Whitley, 1945; Carcharhinus vanrooyeni Smith, 1958.

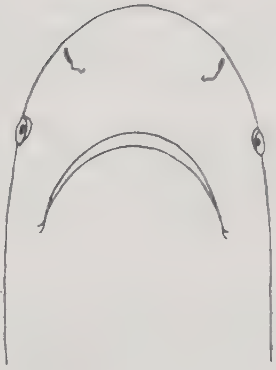
Other Scientific Names Recently in Use : Carcharhinus zambezensis (Peters, 1852); Carcharhinus nicaraguensis (Gill & Bransford, 1877); Carcharhinus azureus (Gilbert & Starks, 1904).

FAO Names : En - Bull shark; Fr - Requin bouledogue; Sp - Tiburón sarda.



Field Marks : A large, stout grey shark with very short, bluntly rounded snout, small eyes, broadly triangular serrated teeth in upper jaw, heavy but narrower cusped teeth with arched roots in lower jaw, upper teeth without cusplets, usually 13/12 rows of anteroposterior teeth, no interdorsal ridge, large angular pectoral fins, a large triangular first dorsal with a short rear tip and a moderately large second dorsal with a short rear tip, fins with dusky tips but not strikingly marked.

Diagnostic Features: A stocky to very heavy-bodied species (stoutest as adults; up to about 3.4 m). Snout very short and bluntly and broadly rounded; internarial width 0.7 to 1 times in preoral length; eyes circular and small, their length 0.8 to 1.8% of total length; anterior nasal flaps expanded or broad-based triangular lobes; upper labial furrows short and inconspicuous; hyomandibular line of pores just behind mouth corners not conspicuously enlarged; gill slits moderately long, the third 3.1 to 4.1% of total length, but less than a third of first dorsal base; usually 13/12 rows of anteroposterior teeth in each jaw half, but varying from 12 to 14/12 to 13; upper teeth with very broad, triangular, strongly serrated, erect to slightly oblique cusps, that merge smoothly with the coarsely serrated crown feet, but with no cusplets; lower teeth with erect to semioblique, broad serrated cusps and arched roots. No interdorsal ridge. First dorsal fin large and broadly triangular to somewhat falcate, with a pointed or sharply rounded apex and posterior margin curving ventrally or posteroventrally from fin apex; origin of first dorsal fin usually over or just behind pectoral insertions, but exceptionally nearer their free rear tips; inner margin of first dorsal short, less than a third of dorsal base or slightly less; second dorsal fin large and high, its height 3.2 to 4.5% of total length, its inner margin short and 0.7 to 1.1 times its height; origin of second dorsal anterior to anal origin; pectoral fins large and broad, triangular to semifalcate, with narrow, pointed apices, length of anterior margins about 18 to 21% of total length; 198 to 227 total vertebral centra, 101 to 123 precaudal centra. Fin tips dusky, especially in young, but not strikingly marked; an inconspicuous white band on flank.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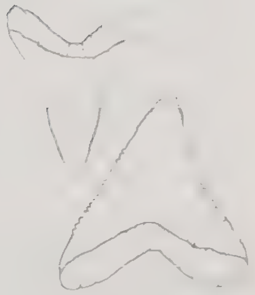
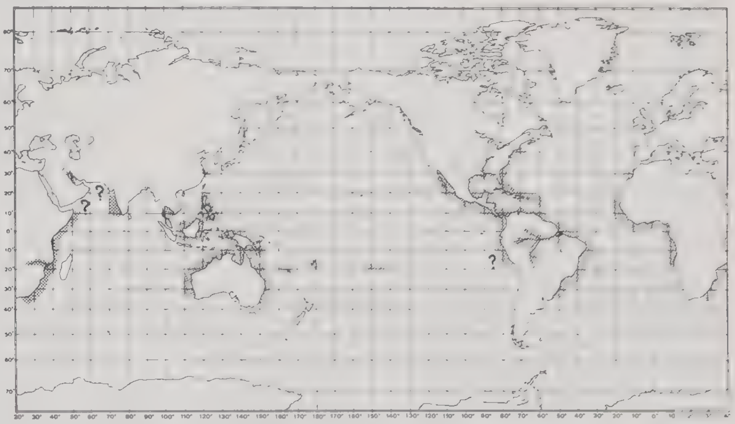

upper and lower tooth

Geographical Distribution: Widespread along the continental coasts of all tropical and subtropical seas and travelling far up warm rivers and into freshwater lakes. Western Atlantic: Massachusetts to southern Brazil, including Gulf of Mexico, Caribbean Sea, and Bahamas; found in Mississippi and Atchafalaya Rivers (southern USA), Lake Nicaragua and San Juan River (Nicaragua), Lake Ysabel (Guatemala), Patula River (Honduras), Panama Canal (Panama), Amazon River (to Peru). Eastern Atlantic: Morocco, Senegal to Angola; found in Gambia River (Gambia) and Ogooue River (Gabon). Western Indian Ocean: South Africa (including Zambezi and Limpopo Rivers), Zimbabwe (Ruenwa River), Kenya, Iraq (Tigris River and Shatt-el Arab), India, including Bombay, Cochin and the Hooghly River, where it occurs along with Glyphis gangeticus; Bass, D'Aubrey & Kistnasamy (1973) give a detailed listing of freshwater localities of the species in southern and southeastern Africa. Western Pacific: Thailand (Gulf of Thailand), Viet Nam, Borneo, New Guinea (including Lake Jamoer), Australia (western and northern Australia, Queensland, New South Wales; including Lake Macquarie and Swan, Brisbane, Herbert, and E. Alligator Rivers), New Caledonia, Fiji, Rangiroa Atoll (Tuamotu Archipelago), The Philippines. Eastern Pacific: Southern Baja California and Gulf of California to Ecuador and possibly Peru.



Habitat and Biology: A coastal, estuarine, riverine and lacustrine shark usually found close inshore in marine habitats, in water less than 30 m deep and occasionally less than a metre deep, but ranging into deeper water close to shore down to at least 152 m depth. In marine habitats it commonly occurs in hyposaline and hypersaline lagoons and bays, river mouths, passages between islands, close to wharves and right off the surf line. It is often found in muddy areas with few other shark competitors. It is the only wide-ranging shark that penetrates far into fresh water and apparently is able to exist there at length in tropical lakes and rivers, to 3700 km from the sea in the Peruvian Amazon, although it may not be able to maintain its entire life cycle in fresh water and does not have landlocked populations there. A population of this shark in Lake Nicaragua was once thought to be landlocked (and a separate species), but members of this population have access to the sea and readily utilize it, although these sharks can and occasionally do breed in the lake (but to a minor extent compared to their use of brackish coastal waters, in estuaries and river mouths). Apparently even newborn bull sharks are euryhaline, and juveniles commonly migrate into fresh water.

In South Africa the bull shark is found in the variably hypersaline St. Lucia lake system and can tolerate salinities of up to $53^{0}/oo$, but tends to move out of the lake when salinities exceed $50^{0}/oo$; unlike bull sharks in freshwater lakes, sharks caught there are in poor condition despite adequate food and ability to feed, which suggests that hypersaline water is suboptimal for them.

This shark is deceptively heavy and slow-swimming when cruising about, usually near the bottom but rarely near the surface except when lured there by offal. When attacking prey it is surprisingly agile and quick in its movements, and readily runs down small sharks and bony fishes. Young individuals are often seen spinning out of the water, possibly to dislodge parasites or for feeding, but larger ones are apparently not prone to jump out of the water.

In the western Atlantic, there is a northward movement of individuals along the US Atlantic coast during the summer from its tropical stronghold, and a southward retreat when the water cools. Off Florida, young and juveniles are found inshore in coastal lagoons, but subadults and adults more to deeper coastal waters; adult females return to lagoons to drop their young.

Viviparous, with a yolk-sac placenta; number of young per litter 1 to 13. Estuaries and river mouths are normally used for pupping grounds; some females may give birth to young in freshwater lakes such as Lake Nicaragua, but this is probably exceptional. In the western North Atlantic off Florida and the Gulf of Mexico, and off South Africa, young are born in late spring or early summer; off Nicaragua females may have young throughout the year, with a peak in spring and early summer. Off South Africa, sexual maturity is attained at an age of about 6 years and 250 cm, with a maximum age of at least 14 years in the wild. In Lake Nicaragua, females may attain a greater age than males as a result of the greater size they attain, 16 years versus 12 years for males. In the western Atlantic mating occurs in the late spring and summer (June and July). An estimated gestation period is 10 to 11 months. Females are often with courtship scars, but males rarely have fighting scars.

The bull shark is hardy and lives readily in captivity, and has been kept in aquaria for over 15 years.

This shark is a versatile and opportunistic feeder, with a very broad food spectrum; its diet was thought by Bigelow & Schroeder (1948) to be "perhaps no less varied than that of the tiger shark". Favoured food includes bony fishes and elasmobranchs, with adults taking more elasmobranch prey than young, probably because of their size and habitat. In Lake Nicaragua, the young eat a more strictly fish diet than the adults, which also take tougher prey such as turtles and mammals. In South Africa, bull sharks from lakes and rivers are almost all immatures and have relatively few prey species available to them, but the more wide-ranging adults can utilize a broader prey spectrum. Bony fishes that are eaten include garfish (Lepisosteus), tarpon, ten-pounders, freshwater eels, snake eels, shad, menhaden and sardines, anchovies, lizardfish, milkfish, gonorhynchids, characins, sea catfish, needlefish, mullet, mackerel and spanish mackerel, tuna, sea bass, perch and striped bass, cichlids, snappers, bluefish, jacks, snook, grunts, snappers, porgies, croakers, spadefish, eleotrid gobies, parrotfish, soles and flounders, gurnards, flatheads, toadfish, and boxfish. This shark is an important predator on other elasmobranchs, particularly on young sharks in inshore nursery grounds and stingrays, and takes bramble sharks, spiny dogfish (Squalus), grey sharks (Carcharhinus, mostly other species, but occasionally cannibalizing young bull sharks), sharpnosed sharks (Rhizoprionodon), hammerheads, guitarfish, sawfish, skates, stingrays, butterfly rays, eagle rays, and devil rays (Mobula). Sea turtles, birds, dolphins, whale offal, and terrestrial mammals in whole and part such as antelope, cattle, people, tree sloths, dogs and rats have also been recorded. Invertebrate prey includes marine crabs and freshwater land crabs, shrimp, hermit crabs, mantis shrimp, squid, sea snails, and sea urchins. Slaughterhouse offal and fish and other animals scavaged from fishing gear is readily taken; however, this shark, is far less prone to swallow inedible garbage than the tigre shark, although such things are occasionally eaten. In estuarine, riverine and lacustrine situations the bull shark may habitually have to rely on other senses than sight to find its prey because of local turbidity; the eyes of this shark are very small and may be of lesser importance than in some other members of its genus with large eyes. Pregnant females about to give birth have been thought to be inhibited in their feeding, but this may not be the case.

This may be the most dangerous species of tropical shark, and is certainly one of the three most dangerous sharks by numbers of attacks recorded on people (the other two being the great white and tiger sharks). As it is less distinctive than either of the other species, and as its genus, Carcharhinus, was until recently a taxonomic disaster, its contribution to the roster of shark attacks may be underemphasized in comparison to the great white and tiger sharks. It would not surprise the writer if this species turned out to be the most dangerous living shark, because of its large size, massive jaws and proportionately very large teeth, abundance in the tropics (off Natal, South Africa, it is caught four times as often as either the great white or tiger sharks in anti-shark nets that protect the bathing beaches), indiscriminate appetite and propensity to take largish prey, and close proximity to human activities in both fresh and salt water. It is well known for its attacks on people (and dogs) in Lake Nicaragua, although the extent of its depredations there are apparently exaggerated.

Size: Maximum about 340 cm, males maturing at 157 to 226 cm and reaching at least 299 cm; females maturing between 180 and 230 cm and reaching at least 324 cm; size at birth between 56 and 81 cm.

Interest to Fisheries: An important fisheries species, because of its abundance and ready availability to inshore artisanal and commercial fisheries (including those in some freshwater lakes such as Lake Nicaragua). It is caught mainly with longlines and hook-and-line gear and utilized fresh, fresh-frozen or smoked for human consumption; its hide is used for leather, its fins for shark-fin soup, and its liver for oil, which is extracted for vitamins (liver oil of this species is high in vitamin content); carcasses are also rendered for fishmeal.

This species is a popular game fish in certain areas, particularly the southeastern Atlantic and Gulf of Mexico coasts of the USA, and off South Africa. It is caught with rod and reel from shore near river mouths, or from breakwaters and piers, and huge individuals, over 200 kg weight, have been subdued after much trevail and scrambling. It is, however, not recognized as a big-game fish by the International Game Fishing Association.

Literature : Bigelow & Schroeder (1948); Cadenat (1957); Springer (1960, 1963); Garrick & Schultz (1963); D'Aubrey (1964, 1971); Boeseman (1964); Clark & von Schmidt (1965); Thorson, Watson & Cowan (1966); Thorson (1971, 1976); Bass, D'Aubrey & Kistnasamy (1973); Tuma (1976); Jensen (1976); Compagno & Vergara (1978); Johnson (1978); Compagno (1979, 1981a); Cadenat & Blache (1981); Van der Elst (1981); Garrick (1982); Thorson & Lacy (1982); Snelson, Mulligan & Williams (1984).

Remarks : This species has been often confused with two other less wide-ranging sympatric species, the pigeye or Java shark, Carcharhinus amboinensis, and the rare, elusive Ganges shark, Glyphis gangeticus. All of these species combine short, rounded preoral snouts with triangular, serrated upper teeth and no interdorsal ridges. From the former, the bull shark differs in its higher, more erect second dorsal fin (ratio of first:second dorsal heights 3:1 or less, but over 3:1 in amboinensis), with a more concave posterior margin, broader angle of the notched posterior anal margin (nearly a right angle, but more acute in amboinensis), higher precaudal vertebral counts (101 to 123, versus 89 to 95), narrower lower tooth cusps, and slightly greater lower anteroposterior tooth counts (usually 12 to 13, versus usually 11).

Most Indo-Pacific records of the Ganges shark in which specimens or adequate descriptive information is available have proved to be based on the bull shark (Boeseman, 1964; Bass, D'Aubrey & Kistnasamy, 1973; Garrick, 1982). Some writers have gone so far as to consider the Ganges shark a synonym of this species (Lineaweaver & Backus, 1970; Ellis, 1975, 1983), although Garrick (1967, 1982) and Garrick & Schultz (1963) have recognized the species. In 1982 the writer was able to independently confirm the validity of the Ganges shark and directly compare it to C. leucas, which occurs in Indian waters. The writer saw specimens of leucas at Cochin, in Kerala, and examined a specimen of this species (Zoological Survey of India, ZSI 2234, 445 mm fetal male) from Bombay, which Day (1878, pl. 187, fig. 1) had described and illustrated as "Carcharias gangeticus". More interesting is a specimen of C. leucas (ZSI 10250, 650 mm term fetus or newborn male) collected in the Hooghly River (part of the Ganges system, and the type locality of Glyphis gangeticus) in West Bengal on 4 April 1867 by Dr J. Anderson and misidentified as 'Squalus gangeticus'. This specimen was collected on the same day and possibly the same place in the Hooghly as a true Ganges shark (see the account of Glyphis gangeticus below), which was misidentified as 'Carcharhinus temmincki'. By comparison of these specimens and the original account of gangeticus (Müller & Henle, 1839) with various accounts of the bull shark this species can be distinguished from the Ganges shark by its shorter preorbital snout (about 6% of total length in young leucas but decreasing in adults, versus 7.2% in young gangeticus), lower second dorsal fin (up to 2/4 of first dorsal height, versus 1/2 or more in gangeticus), a more abruptly vertical posterior margin on the first dorsal fin (sloping more gradually posteroventrally in the Ganges shark), a different type of upper precaudal pit (transverse and crescentic, versus longitudinal and fossate in the Ganges shark), a larger eye (about 1.8% of total length in young leucas, but 1% in young gangeticus), a different eye position (lateral in the bull shark, dorsolateral and tilted upward in the Ganges shark), slightly different gill arrangement (increasing in size from first to third slits and then decreasing to the fifth in the bull shark, but decreasing from first to fifth in the Ganges shark), less numerous anteroposterior teeth, (usually 13 upper rows versus at least 15 rows in the larger shark) much lower and more obtusely triangular upper teeth, and strikingly different lower anterior teeth (low and with broad, thick, straight cusps, no lateral cusplets, and coarse serrations in the bull shark versus high and with long, slender, hooked cusps, low lateral cusplets, and smooth edges in the Ganges shark) that do not protrude when the mouth is closed. The presence of two species of 'Ganges' sharks in fresh water in the Hooghly, and by implication the Ganges, suggests that the horrific reputation accorded the true Ganges shark may be at least a collective effect of it and the bull shark, or mainly due to the more powerfully armed, omnivorous bull shark.

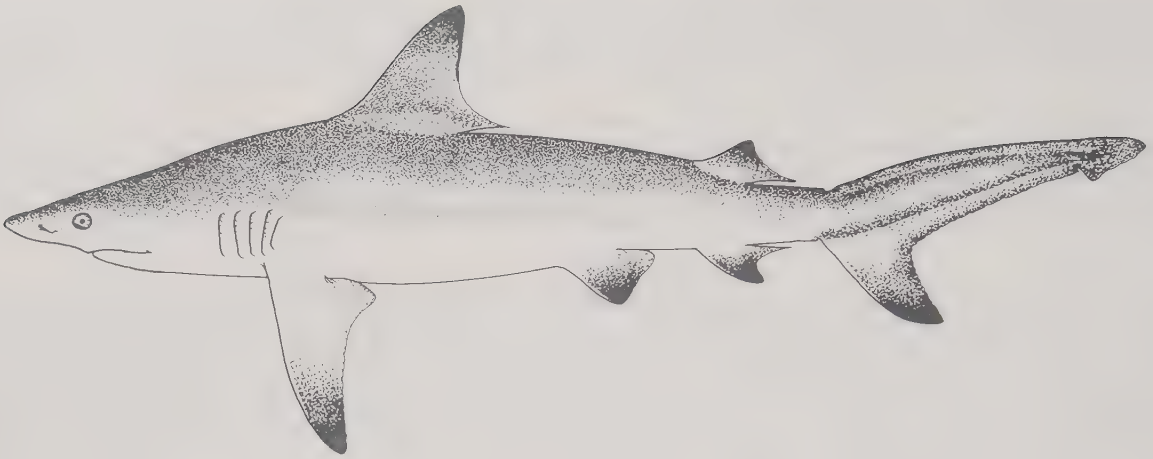
Carcharhinus limbatus (Valenciennes, 1839)

CARCH Carch 7

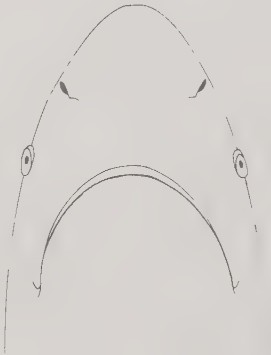
Carcharias (Prionodon) limbatus Valenciennes, in Müller & Henle, 1839, Syst.Beschr.Plagiost., (2):49, pl. 19 (teeth only). Holotype: Type series (2 specimens) in Museum National d'Histoire Naturelle, both lost? Type Locality: Martinique.

Synonymy : Carcharias microps Lowe, 1840; Carcharias (Prionodon) pleurotaenia Bleeker, 1852; Carcharias (Prionodon) muelleri Steindachner, 1867 (not Carcharias (Physodon) muelleri Valenciennes, in Müller & Henle, 1839 = Scoliodon laticaudus); ?Carcharias maculipinna Günther, 1868 (not Isogomphodon maculipinnis Poey, 1865 = Carcharhinus brevipinna); Carcharias ehrenbergi Klunzinger, 1871; Carcharias aethlorus Jordan & Gilbert, 1882; Gymnorhinus or Gymnorrhinus abbreviatus Hemprich & Ehrenberg, 1899; Carcharias phorcys Jordan & Gilbert, 1903; Carcharhinus natator Meek & Hildebrand, 1923; Galeolamna pleurotaenia tilsoni Whitley, 1950.

FAO Names : En - Blacktip shark; Fr - Requin bordé; Sp - Tiburón macuira.



Field Marks: A large fairly stout grey shark with a long pointed snout, small eyes, narrow, mostly erect- and narrow-cusped serrated upper anterolateral teeth without cusplets, long gill slits, lower teeth with narrow, usually serrated cusps, usually 15/14 to 15 rows of anterolateral teeth, no interdorsal ridge, moderately large pectoral fins, a large first dorsal with a short rear tip and a moderately large second dorsal with a short rear tip, and usually black tips on most fins in juveniles to adults.



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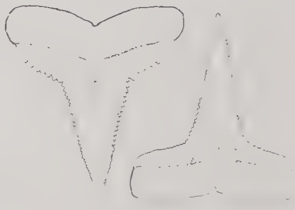
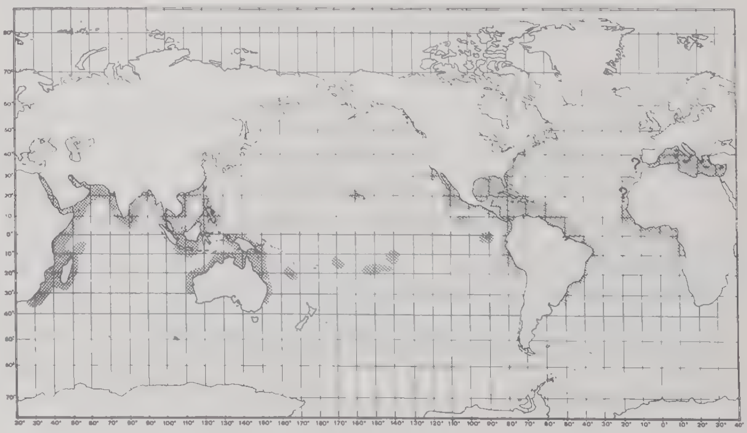


upper and lower tooth

Diagnostic Features: A fairly stocky species (up to about 2.6 m). Snout moderately long and moderately pointed; internarial width 1.3 to 1.7 times in preoral length; eyes circular and moderately large, their length 1.2 to 2.2% of total length; anterior nasal flaps low, triangular, and not elongated; upper labial furrows short and inconspicuous; hyomandibular line of pores just behind mouth corners not conspicuously enlarged; gill slits long, the third 3.8 to 4.9% of total length but less than half of first dorsal base; usually 15/14 to 15 rows of anteroposterior teeth in each jaw half but varying from 14 to 16/13 to 16; upper teeth with narrow, strongly serrated, erect to slightly oblique high cusps, and crown feet with slightly coarser serrations but no cusplets; lower teeth with erect, narrow, serrated high cusps and transverse roots. No interdorsal ridge. First dorsal fin large and falcate, with a pointed or narrowly rounded apex and posterior margin curving ventrally from fin apex; origin of first dorsal fin usually over or slightly posterior to pectoral insertion, but exceptionally near the pectoral free rear tip; inner margin of first dorsal short, about a third of dorsal base; second dorsal fin large and high, its height 2.5 to 3.6% of total length, its inner margin short and 1.1 to 1.6 times its height; origin of second dorsal over or slightly anterior to anal origin; pectoral fins moderately large, falcate, with narrowly rounded or pointed apices, length of anterior margins about 18 to 20% of total length in individuals above 1 m long; 174 to 203 total vertebral centra, 88 to 102 precaudal centra. Colour grey or grey-brown above, white below; black tips usually present on pectorals, second dorsal, and ventral caudal lobe, and sometimes on pelvic and anal fins (anal usually plain), and black edges usually present on first dorsal apex and dorsal caudal lobe; adults in some areas may have plain or virtually plain fins. A conspicuous white band on flanks.

Geographical Distribution: Widespread in all tropical and subtropical continental waters. Western Atlantic: Massachusetts to southern Brazil, including Gulf of Mexico and Caribbean. Eastern Atlantic: Madeira, Mediterranean, Canary Islands, Senegal to Zaire. Indo-West Pacific: South Africa, Madagascar, and Red Sea to India, Sri Lanka, Pakistan, Thailand, China, including Taiwan Island, The Philippines, Java, Borneo, Australia (Queensland, Western Australia, Northern Territory), New Guinea, New Caledonia. Central Pacific: Tahiti, Marquesas, Hawaiian Islands. Eastern Pacific: Southern Baja California (exceptionally to San Diego, California) to Peru, Revillagigedo and Galapagos Islands.



Habitat and Biology : A common tropical and warm-temperate, inshore and offshore pelagic shark, found on or adjacent to the continental and insular shelves but not truely oceanic. Commonly occurs close inshore, off river mouths and in estuaries, in shallow muddy bays, in the more saline parts of mangrove swamps, in island lagoons and along dropoffs on coral reefs as well as far offshore; rarely found deeper than 30 m. It can tolerate reduced salinities in estuaries and off river mouths, but does not penetrate far into fresh water.

Off Natal, South Africa, there is evidence of segregation of the local population. Sharks resident there consist mostly of adult males and non-pregnant females, with the addition of few young and adolescent individuals and periodic influxes of pregnant females during the spring; pregnant females mostly do not pup there but apparently migrate elsewhere, possibly to southern Mozâmbique where nursery grounds may occur. Off Florida these sharks are seasonally migratory and are absent during winter months.

This is a very active, fast-swimming shark that often occurs in large schools at the surface. It leaps out of the water, and like the related spinner shark (C. brevipinna), may rotate up to three times around its axis before dropping back into the sea. It is a less common spinner and leaper than its relative, however. This leaping-spinning behaviour is thought to be used by the sharks while feeding on small schooling fishes; the sharks launch themselves vertically through the schools, spinning and snapping in all directions, and then breach the surface after their feeding run.

Viviparous, with a yolk-sac placenta; number of young 1 to 10 per litter, commonly 4 to 7. The gestation period is 10 to 12 months, with young being born in late spring or early summer off South Africa, Madagascar, India and in the North Atlantic (April to June) and mating and early growth of embryos occurring soon after this. Pregnant females move inshore to drop their young in nursery and pupping grounds. Maturity in South African waters occurs at an age of four years and a length of about 180 cm, with a maximum age of at least 12 years. Females are thought to produce young only in alternate years.

Primarily a fish-eater, with some cephalopods and crustaceans taken. Food includes a wide variety of bony fishes, including sardines, menhaden, herring and other clupeids, anchovies, ten-pounders (Elopidae), sea catfish, coronetfish, tongue-soles, threadfins, mullet, spanish mackeral, jacks, groupers, snook, porgies, mojarras, emperors (Lethrinidae), grunts, slipjaws, butterfish, croakers, soles, tilapia, triggerfish, boxfish and porcupine fish, as well as small sharks such as smooth-hounds (Mustelus), sharpnose sharks (Rhizoprionodon), the young of larger sharks (including dusky sharks), guitarfish, skates, butterfly rays, stingrays, eagle rays, squid, cuttlefish, octopi, crabs and lobsters. The high activity of this shark (aided perhaps by its relatively long gill slits) and its social behaviour makes it subject to feeding frenzies when a highly concentrated food source, like the fish bycatch of a shrimp trawler being dumped overboard, is competed for by numbers of these sharks.

Very few attacks on people have been attributed to this species, and it is likely that without a food stimulus or other special circumstances (like feeding stimuli provided by people that dangle their limbs in the water) that this species is of little hazard to people. Small individuals of this shark have approached divers, apparently out of 'curiosity', but circled them at a distance without closing, and appeared far more timid than Galapagos sharks (C. galapagensis) or silvertips (C. albimarginatus), which dominated them in contests for food. However, the blacktip commonly appears around spearfishing divers and has harassed them; and can get very aggressive and actively belligerant when contending a speared catch with a diver. Hence it should be treated with respect in baited circumstances, as with many other large sharks. Its speed may make the blacktip a difficult opponent when it becomes aggressive, particularly when several sharks are about and they become hyperstimulated.

Size : Maximum 255 cm, males maturing at about 135 to 180 cm and reaching 226 to possibly 255 cm, females maturing at about 120 to 190 cm and reaching 255 cm; size at birth 38 to 72 cm.

Interest to Fisheries : A common fisheries species, taken with floating longlines, hook-and-line, fixed bottom nets, and bottom trawls (especially shrimp trawls). Utilized fresh, fresh-frozen, or dried salted for human consumption; hides for leather; liver oil for vitamins (oil high in vitamin content); and carcasses for fishmeal.

Commonly taken by anglers trolling bait or stillfishing offshore in Florida and South African tropical waters. It may give an active, fast, spirited fight and even leap out of the water when hooked, like a low-powered mako, but sometimes is more dogged and loglike in its struggle. It is not recognized as a game fish by the International Game Fish Association.

Literature : Fowler (1941); Bigelow & Schroeder (1948); Setna & Sarangdhar (1949a); Cadenat (1957); Springer (1960, 1963); Garrick & Schultz (1963); Limbaugh (1963); Randall (1963); Clark & von Schmidt (1965); Garrick (1967, 1982); Bass, D'Aubrey & Kistnasamy (1973); Johnson (1978); Van der Elst (1981); Cadenat & Blache (1981).

Carcharhinus longimanus (Poey, 1861)

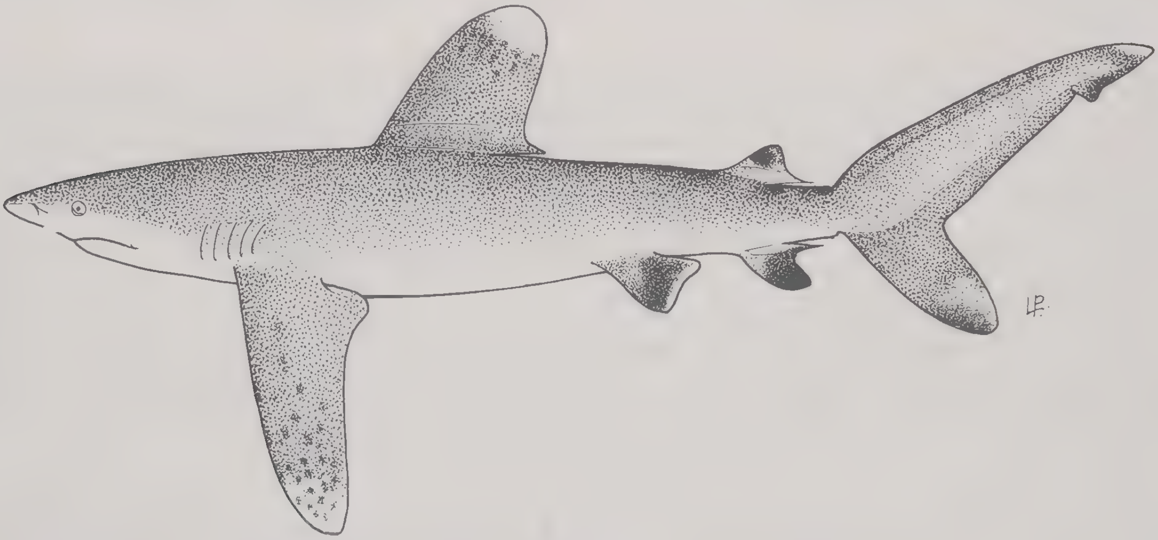
CARCH Carch 8

Squalus longimanus Poey, 1861, Memorias, 2:338, pl. 19, figs 9-10. Placed on the Official List of Specific Names in Zoology by the International Commission on Zoological Nomenclature (Opinion 723.4e, 1965, Name no. 2059). Holotype: Male of 1640 mm, extant? Type Locality: Cuba.

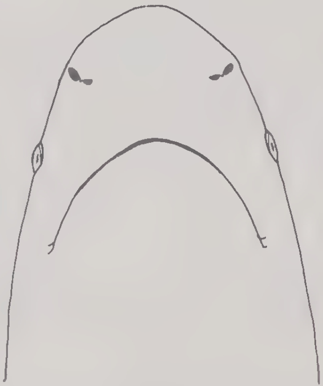
Synonymy : Squalus (Carcharias) maou Lesson, 1830; Carcharias (Prionodon) obtusus Garman, 1881 (not Squalus or Prionodon obtusus Poey, 1861 = Carcharhinus leucas); Carcharias insularum Snyder, 1904; Pterolamiops magnipinnis Smith, 1958; Pterolamiops budkeri (Fourmanoir, 1961).

Other Scientific Names Recently in Use : Carcharhinus maou (Lesson, 1830); Pterolamiops longimanus (Poey, 1861).

FAO Names : En - Oceanic whitetip shark; Fr - Requin océanique; Sp - Tiburón oceánico.



Field Marks : An unmistakable requiem shark, with stocky build, short blunt snout, and long, broad, paddle-shaped pectoral fins and a high first dorsal fin, plus white tips and sometimes black markings on fins.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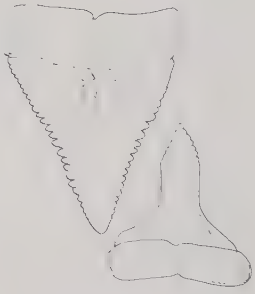
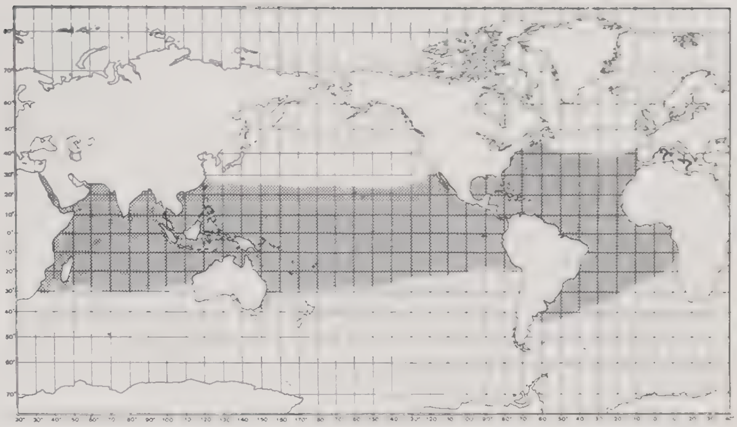

upper and lower tooth

Diagnostic Features : A large, stocky species (up to about 3 m or more). Snout short and broadly rounded; internarial width 1 to 1.1 times in preoral length; eyes circular and small, their length 0.9 to 2.5% of total length; anterior nasal flaps low and broadly angular, not expanded; upper labial furrows short and inconspicuous; hyomandibular line of pores just behind mouth corners not conspicuously enlarged; gill slits moderately long, third 3.1 to 4.1% of total length and less than a third of first dorsal base; usually 14/14 rows of anteroposterior teeth in each jaw half but varying from 13 to 14/13 to 15; upper teeth with very broad, triangular, strongly serrated, erect to slightly oblique cusps that merge into crown feet with slightly coarser serrations but no cusplets; lower teeth with erect to slightly oblique, stout serrated cusps and transverse or moderately arched roots. A low interdorsal ridge usually present. First dorsal fin very large and distally expanded, not falcate, with a broadly rounded apex and posterior margin curving anteroventrally and posteroventrally from fin apex; origin of first dorsal fin just anterior to the pectoral free rear tips; inner margin of first dorsal moderately long, half dorsal base or somewhat less; second dorsal fin large and high, its height 2.7 to 3.9% of total length, its inner margin short and 1 to 1.1 times its height; origin of second dorsal over or slightly anterior to anal origin; pectoral fins very large, elongated, nearly straight and distally expanded, with broadly rounded apices, length of anterior margins about 19 to 29% of total length; 228 to 244 total vertebral centra, 123 to 131 precaudal centra. Colour grey-bronze above, white below; white mottling usually present on fins, particularly pectorals, first dorsal, pelvics, and caudal tips; but young additionally with black blotches or tips on most fins, especially the pelvic, second dorsal, anal, and ventral caudal lobe, as well as black saddles at second dorsal insertion, upper caudal origin, and sometimes between the dorsal fins, that fade in adults; an inconspicuous white band on flank.

Geographical Distribution : Primarily oceanic in tropical and warm-temperate waters. Western Atlantic: Maine to Argentina, including Caribbean and Gulf of Mexico. Central Atlantic. Eastern Atlantic: Madeira, Portugal south to the Gulf of Guinea, possibly Mediterranean Sea. Western Indian Ocean: South Africa, Madagascar, Mozambique, Mauritius and Seychelles, Red Sea, India. Western Pacific: China (including Taiwan Island), the Philippines, New Caledonia, Australia (southern Australian coast). Central Pacific: Hawaiian Islands south to Samoa Islands, Tahiti and Tuamotu Archipelago and west to Galapagos Islands. Eastern Pacific: Southern California to Peru, including Gulf of California and Clipperton Island.



Habitat and Biology : A common, oceanic-epipelagic, but occasionally coastal, tropical and warm-temperate shark, usually found far offshore in the open sea. It sometimes occurs in water as shallow as 37 m inshore, particularly off oceanic islands or in continental areas where the shelf is very narrow, but is generally found in water with the bottom below 184 m, from the surface to at least 152 m deep. Temperatures of waters in which it regularly occurs are 18° to 28°C and normally prefers water above 20°C, although one was caught in water of 15°C; it tends to withdraw from waters that are cooling below this, as in the Gulf of Mexico in winter.

Population dynamics and structure are little-known. Apparently size and sexual segregation occurs in this shark as in many other species. Longline catches in the Central Pacific show it definitely increases in abundance as a function of increasing distance from land, and, unlike the silky shark (Carcharhinus falciformis) but as in the blue shark (Prionace glauca), it does not congregate around land masses. The oceanic whitetip is most abundant in the tropics from 20°N to 20°S, but with appropriate movements of warm-water masses can occur far beyond its normal range. At the time of writing (November, 1983), a warm-water incursion along the California coast in the USA has, among other species, brought the oceanic whitetip far north, to off of Catalina Island in southern California and possibly to northern California (B. Lea, pers. comm.). This is one of the three most abundant oceanic sharks (the other two being the silky and blue sharks), and one of the more abundant of large marine organisms. It apparently does not form polarized schools, though it may aggregate in numbers around a food source.

This shark is slow-moving but quite active and apparently equally so at daytime or night. It often cruises slowly at or near the surface with its huge pectoral fins conspicuously outspread, but can suddenly dash for a short distance when greatly disturbed. It is much more leisured in its movements than the silky shark (which is often found along with it), but compensates for it by being far more aggressive, especially when competing for food with silky sharks. Similar-sized whitetips generally dominate silky sharks when the two are closely contesting the same piece of food, but if the food drifts much beyond the reach of the whitetip the silky shark generally grabs it and flees because of its greater speed and agility. The oceanic whitetip is cautious in investigating hooked baits but very bold and incredibly persistant in attending potential sources of food.

Viviparous, with a yolk-sac placenta; litter sizes 1 to 15, with larger females having larger litters. This shark apparently mates and gives birth in the early summer in the western North Atlantic and southwestern Indian Ocean, and has a gestation period of about a year. In the central Pacific, females with small embryos have been found throughout the years, suggesting a less tight seasonality of birth (and presumably mating) than the western Atlantic. Also, non-breeding adult females have been found to outnumber gravid females in the equatorial central Pacific.

Feeds primarily on oceanic bony fishes and cephalopods, including lancetfish, oarfish, threadfins, barracuda, jacks, dolphinfish, tuna, skipjack and other scombrids, marlin, squid and occasionally stingrays (probably Dasyatis violacea, the unique pelagic stingray), sea birds, turtles, marine gastropods, crustaceans, carrion from marine mammals, and garbage. It was seen feeding on a tight school of threadfins like a person eating an apple, by slowly taking bites out of the school. Whitetips have been observed feeding in a remarkable way on dense schools of small tuna that were in turn frenziedly feeding on sardines at the surface. Quite a number of whitetip cruised erratically at the surface in the middle of the tuna with mouths wide open; they did not attempt to snap or chase any of the tunas during the course of a half hour's observation. As several of the whitetips captured had these tuna in their stomachs, it was suggested that the sharks merely wait for the tuna to dash into their open mouths before biting them! The oceanic whitetip is a pest to longline fisheries for tuna and other pelagic fishes because it persistantly accompanies the boats and damages or totally devours the catches. When warm-water whale fisheries were operated, such as the sperm-whale fishery out of Durban, South Africa, this shark was often responsible for most of the damage to floating carcasses. They have powerful jaws and large teeth, albeit less so than the bull and pigeye sharks (C. leucas and C. amboinensis). Divers have filmed them removing huge chunks out of dead whales and dolphins, which they readily do by biting and shaking to drive the teeth through the meat.

This is a dangerous species, responsible for a few verified and unverified attacks on swimmers and boats. Divers have encountered it in the open ocean, and it has shown extreme persistence in investigating and circling them both in baited and unbaited situations, possibly as a prelude to an attack. The whitetips were fended off before they might bite; however, they often would return to circle and approach again. Various actions to frighten off these sharks usually have limited or no effects, unlike many other species, including the great white, that often flee when aggressively confronted. In the film 'Blue water, white death' these sharks were filmed feeding on a sperm whale carcass off Durban, South Africa. Few sharks were actively feeding although many were present and seemed bloated from previous meals; but the diving team involved were slowly but persistently approached by apparently sated whitetips, and had to deter them from approaching too close and possibly attacking by bumping them on the snout. This shark was thought by Bass, D'Aubrey & Kistnasamy (1973) to have been chiefly responsible for the deaths of many people in the water after the ship "Nova Scotia" was torpedoed and sunk by a German submarine during the second world war off northern Natal, South Africa. Because of its opportunistic feeding habits, heavy build, strong jaws and teeth, and stubborn aggressiveness, this shark should be treated with extreme care. Fortunately some potential attacks on divers have been averted by prompt action on their part and by the slowness of the approaching whitetips.

Size : Maximum possibly 350 to 395 cm for gigantic individuals, but most are below 300 cm; males maturing at 175 to 198 cm and reaching at least 245 cm, females maturing at about 180 to 200 cm and reaching at least 270 cm; size at birth 60 to 65 cm.

A length-weight curve for Cuban sharks is:

$$WT = 0.7272 \times 10^{-4} TL^{2.678}$$ (Guitart Manday, 1975).

Interest to Fisheries : This is a wide-ranging, common oceanic shark that is regularly caught with pelagic longlines, also handlines and occasionally pelagic and even bottom trawls. It is utilized fresh, smoked and dried salted for human consumption, for hides, for fins (processed into the ingredients for shark-fin soup), and for liver oil (extracted for vitamins) and fishmeal.

Literature : Bigelow & Schroeder (1948); Springer (1950); Backus, Springer & Arnold (1956); Smith (1958); Strasberg (1958); Fourmanoir (1961); Garrick & Schultz (1963); Randall (1963); Gohar & Mazhar (1964); Garrick (1967, 1982); Lineaweaver & Backus (1970); Costeau & Costeau (1970); Bass, D'Aubrey & Kistnasamy (1973); Guitart Manday (1975); Compagno & Vergara (1978); Compagno (1981a); Cadenat & Blache (1981).

Remarks : The earliest available name for this species is apparently Squalus (Carcharias) maou Lesson, 1830, but due to the wider usage and placement on the Official List of Specific Names in Zoology of Squalus longimanus Poey, 1861 Garrick (1982) decided to use it instead of S. maou; this action is followed here.

Carcharhinus macloti (Müller & Henle, 1839)

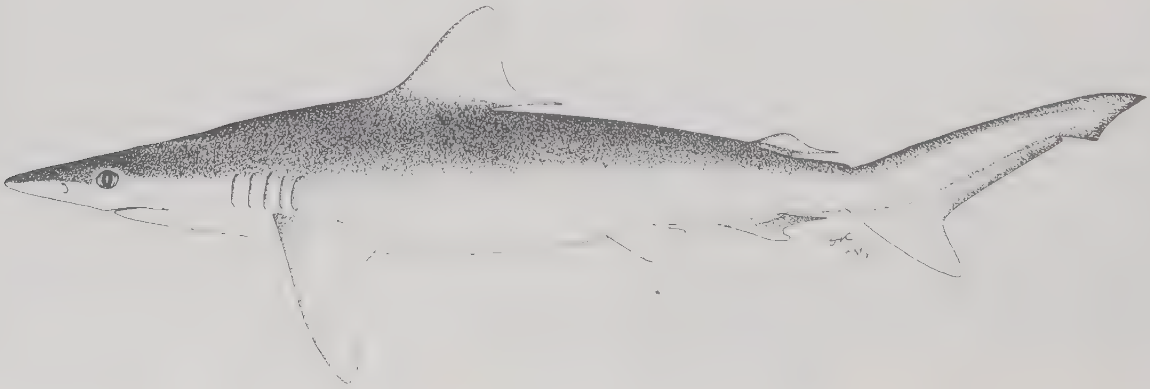
CARCH Carch 22

Carcharias (Hypoprion) macloti Müller & Henle, 1839, Syst.Beschr.Plagiost., (2):34, pl. 10. Holotype: Rijksmuseum van Natuurlijke Historie, Leiden, adult male. Type Locality: New Guinea.

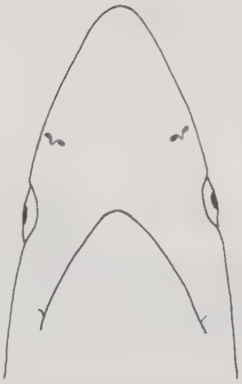
Synonymy : None.

Other Scientific Names Recently in Use : Hypoprion macloti (Müller & Henle, 1839).

FAO Names : En - Hardnose shark; Fr - Requin à nez rude; Sp - Tiburón trompudo.



Field Marks : A small slender grey shark with a long narrowly rounded or somewhat pointed snout, fairly large eyes, oblique-cusped smooth-edged upper anterolateral teeth with strong proximal and distal cusplets, no interdorsal ridge, small pectoral fins, a small first dorsal with an extremely long rear tip, a small low second dorsal with a long rear tip, and no conspicuous markings on fins. Also, this is the only member of its genus with a hypercalcified rostrum, which can easily be felt by pinching its snout.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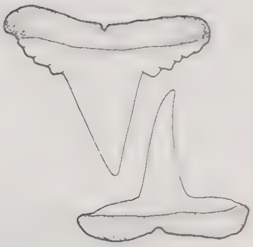

upper and lower tooth

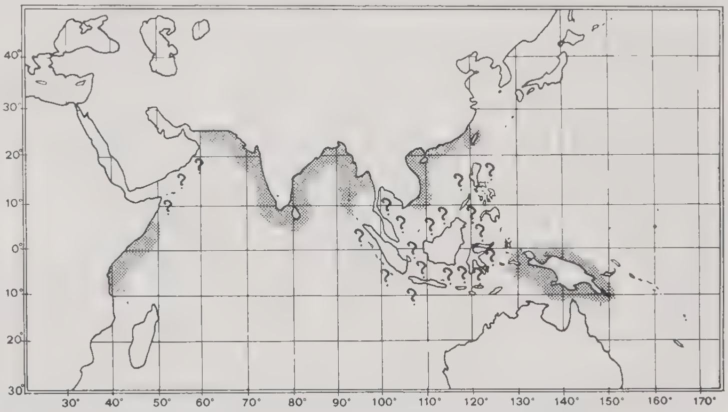
Diagnostic Features : A small, slender species (length to less than 1 m). Snout long and narrowly rounded or slightly pointed; internarial width 1.5 to 1.9 times in preoral length; eyes circular and moderately large, their length 1.8 to 2.5% of total length; anterior nasal flaps expanded as a narrow nipple-shaped lobe; upper labial furrows short and inconspicuous; hyomandibular line of pores just behind mouth corners not conspicuously enlarged; gill slits short, third 2.8 to 3.5% of total length and about a third of first dorsal base; about 13 to 14/10 to 14 rows of anteroposterior teeth in each jaw half; upper teeth with narrow, entirely smooth, mostly oblique or semioblique, moderately high cusps, and crown feet with strong distal and proximal cusplets but no serrations; lower teeth with oblique, moderately high smooth cusps and transverse roots. No interdorsal ridge. First dorsal fin moderate-sized and falcate, with a pointed or narrowly rounded apex and posterior margin curving ventrally from fin apex; origin of first dorsal fin usually over or somewhat anterior to the pectoral free rear tips; inner margin of first dorsal extremely long, about two-thirds of dorsal base; second dorsal fin small and low, its height 1.8 to 2% of total length, its inner margin elongated and 2.3 to 2.4 times its height; origin of second dorsal well behind anal origin, near anal midbase; pectoral fins small, falcate, with narrowly rounded or pointed apices, length of anterior margins about 14 to 16% of total length; 151 to 156 total vertebral centra. Colour grey or grey-brown above, white below, fins with light edges but not conspicuously marked; light flank marks not conspicuous.

Geographical Distribution : Indo-West Pacific: Kenya, Tanzania, Pakistan, India, Sri Lanka, Andaman Sea, Burma, Viet Nam, China (including Taiwan Province), New Guinea.

Habitat and Biology : A small, common but little-known inshore shark of the continental and insular shelves.

In Bombay waters over 95% of the individuals caught are males, the rest females, indicating strong sexual segregation within its populations.

Viviparous, with a yolk-sac placenta; number of young 1 or 2 (usually 2) to a litter.



Probably feeds on small fishes, cephalopods and crustaceans, but diet apparently not reported.

Size : Maximum size probably below 100 cm, adult males maturing at about 69 cm and reaching 81 cm, adult females 76 to 89 cm; size at birth 45 to 50 cm.

Interest to Fisheries : Apparently regularly caught off Pakistan, Sri Lanka, India and China; caught by gillnet and by line gear, and utilized fresh and probably dried salted for human consumption.

Literature : Garman (1913); Fowler (1941); Setna & Sarangdhar (1949); Chen (1963).

Carcharhinus melanopterus (Quoy & Gaimard, 1824)

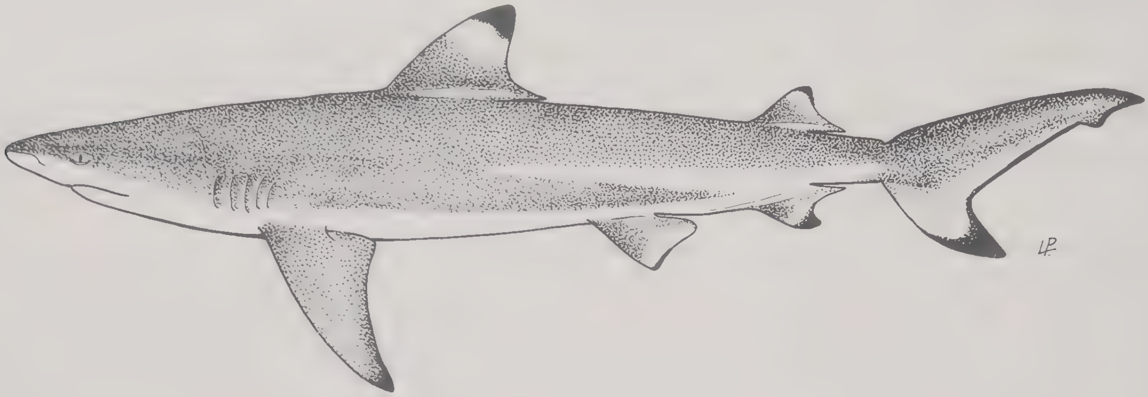
CARCH Carch 23

Carcharias melanopterus Quoy & Gaimard, 1824, Zoologie, Voy.Uranie et Physicienne, 1877-20:194, pl. 43, figs 1-2. Holotype: Museum National d'Histoire Naturelle, Paris, MNHN 1129, 590 mm immature male. Type Locality: Waigeo Islands.

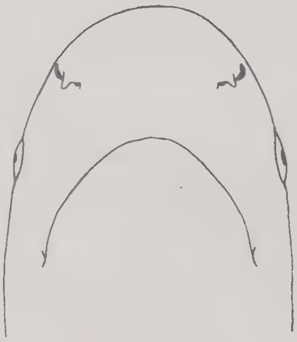
Synonymy : Squalus (Carcharhinus) commersoni Blainville, 1816 (nomen nudum); Carcharias playfairi Günther, 1870; Carcharias elegans Hemprich & Ehrenberg, 1899; Carcharias marianensis Engelhardt, 1912.

Other Scientific Names Recently in Use: Mapolamia spallanzanii (not Peron & LeSueur, in LeSueur, 1822, equals C. sorrah); Hypoprion playfairi (Günther, 1870).

FAO Names: En - Blacktip reef shark; Fr - Requin pointes noires; Sp - Tiburón de puntas negras.



Field Marks: A moderate-sized, brownish 'grey shark' with a short, bluntly rounded snout, horizontally oval eyes, no interdorsal ridge, a moderately large second dorsal with a short rear tip, and brilliant black blotches on the first dorsal apex, lower caudal lobe, and black tips on other fins.



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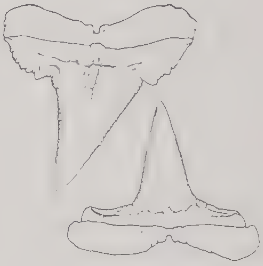
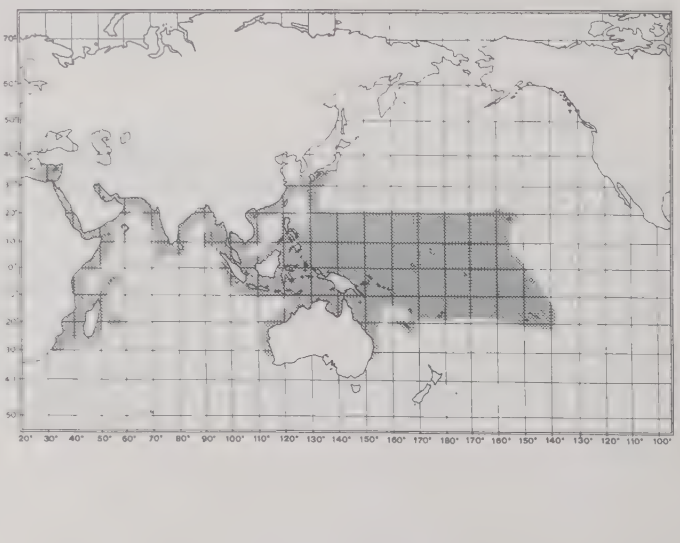


upper and lower tooth

Diagnostic Features: A fairly stocky species (most adults less than 1.6 m). Snout short and bluntly rounded; internarial width 0.9 to 1.1 times in preoral length; eyes usually horizontally oval and fairly large, their length 2 to 3% of total length; anterior nasal flaps moderately elongated and expanded as nipple-shaped lobes; upper labial furrows short and inconspicuous; hyomandibular line of pores just behind mouth corners not conspicuously enlarged; gill slits moderate-sized, the third 2.6 to 4.2% of total length and less than a third of first dorsal base; usually 12/11 rows of anteroposterior teeth in each jaw half but varying from 11 to 13/10 to 12; upper teeth with narrow, strongly serrated, erect to oblique, high cusps, and crown feet with coarser serrations and cusplets; lower teeth with erect to oblique, narrow serrated cusps and transverse roots. No interdorsal ridge. First dorsal fin large and falcate, with a rounded apex and posterior margin curving ventrally from fin apex; origin of first dorsal fin usually over pectoral free rear tips; inner margin of first dorsal moderately long, slightly more or less than half dorsal base; second dorsal fin large and high, its height 3.4 to 4.1% of total length, its inner margin short and 0.8 to 1.1 times its height; origin of second dorsal over anal origin; pectoral fins moderately large, narrow and falcate, with narrowly rounded or pointed apices, length of anterior margins about 17 to 19% of total length; 193 to 214 total vertebral centra, 111 to 122 precaudal centra. Colour usually light brown above, white below; first dorsal and ventral caudal lobe with a conspicuous black apical blotch, brilliantly highlighted proximally with white; other fins, generally with less prominent black fin tips; a conspicuous white band on flank.

Geographical Distribution: Eastern Mediterranean Sea (apparently as an invader through the Suez Canal from the Red Sea). Indian Ocean: South Africa, Mauritius, Seychelles, and Madagascar to Red Sea, the "Gulf", Pakistan, India, Sri Lanka, Andaman and Maldive Islands. Western Pacific: Thailand (Gulf of Thailand) to China (including Taiwan Province), Japan, The Philippines, Australia (Queensland, Northern Territory and Western Australia), and New Caledonia. Wide-ranging in the island groups of the western central Pacific, from the Hawaiian and Marshall Islands south to the Tuamotu Archipelago. Apparently rare or absent in more easterly groups including the Marquesas, Pitcairn, Tubuai (Rapa) Islands, Austral Ridge, Johnston, Marcus and Easter Islands.



Habitat and Biology : This small, common, wide-ranging tropical Indo-Pacific shark prefers shallow water close inshore on coral reefs, at depths of only a few metres and commonly in the intertidal zone, often on reef flats in water 30 cm deep or less; also found near reef dropoffs and occasionally close offshore. This is one of the three commonest sharks on coral reefs in tropical Oceania (the other two being the whitetip reef shark, Triaenodon obesus, and the grey reef shark, C. amblyrhynchos. It apparently now inhabits warmer parts of the Mediterranean Sea, having invaded it through the Suez Canal. It is thought to penetrate into at least brackish lakes and estuaries in Madagascar and into fully fresh water in Malaysia, but its ability to tolerate fresh water for any length of time is uncertain; whatever the case, it apparently is not able to utilize fresh water to the extent that Carcharhinus leucas does. At the northern and southern extremes of its range the blacktip may be a migrant, but this is uncertain.

The blacktip reef shark is an active, strong-swimming shark, found near the bottom and at midwater in deeper water, and with its dorsal fins protruding in the shallows. It occurs singly or in small groups or aggregation, but is not strongly schooling.

Viviparous, with a yolk sac placenta; number of young 2 to 4, usually 4. Gestation period possibly 16 months, with birth season from late winter to early summer.

Eats small fish and invertebrates, including mullet, groupers, theraponids, jacks, mojarras, slipjaws, wrasses, surgeonfish, sillaginids, cuttlefish, squid, octopi, shrimp, and manis shrimp. Not an extremely dangerous species because of its small size and general timidity when approached by divers in unbaited situations, but definitely a hazard to spearfishers and to people wading in the water. It is often quite inquisitive when divers enter the water, but can be usually driven off. It often becomes aggressive when speared fish are about, which may be exacerbated by the presence of competing sharks, and will rush in to take wounded fish or baits, although in general it is less aggressive in this sort of activity than the grey reef shark (Carcharhinus amblyrhynchos). It must be ranked as a dangerous species because it is the shark most commonly encountered by people in the tropical Indo-Pacific, and has definitely been responsible for several unprovoked and provoked attacks on people (none fatal and most without major injury to people). Its danger is somewhat qualified by the nature of its attacks, primarily on people wading in shallow water. Most blacktip attacks appear to be 'mistaken identity' attacks, made on the legs of people the shark may be mistaken for its ordinary small, non-mammalian prey. Randall & Helfman (1973) note that Marshall Islanders swim rather than wade across shallow island passes to avoid blacktip attacks on their legs, and suggest that people who see an approaching blacktip while wading in shallow water and have nothing to defend themselves with should consider submerging as much of their body as possible to scare off the shark.

Enemies of this species include large groupers and probably other sharks.

Size : Maximum less than 200 cm, one specimen reported as 180 cm (an unusually large adult male), but most adults less than 160 cm; males maturing at 91 to about 100 cm and reaching 180 cm (most adult males up to 134 cm), females maturing between 96 and 112 cm and reaching 131 cm; size at birth between 33 to 52 cm.

Interest to Fisheries : Apparently regularly caught in fisheries where this common inshore shark occurs, including off of India and Thailand; but details of its utilization and gear used are lacking.

Literature : Fowler (1941); Bass, D'Aubrey & Kistnasamy (1973); Randall & Helfman (1973); Johnson (1978); Garrick (1982).

Remarks : Carcharias playfairi is synonymized with this species following Bass, D'Aubrey & Kistnasamy (1973). See Boeseman (1960) and Garrick (1982) for the nomenclatural history of Squalus commersoni.

Carcharhinus obscurus (LeSueur, 1818)

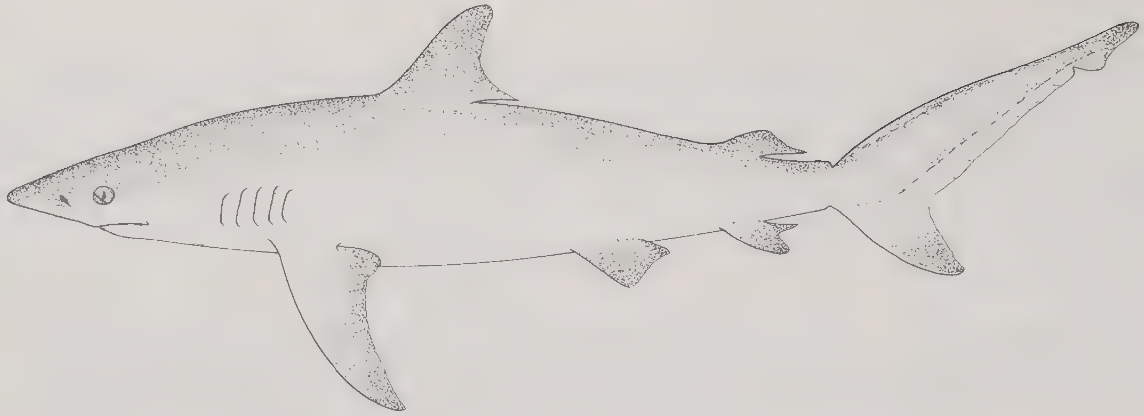
CARCH Carch 9

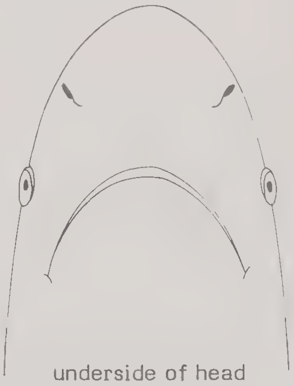
Squalus obscurus LeSueur, 1818, J.Acad.Nat.Sci.Philad., 1(2):223, pl. 9. Holotype: None. Type Locality: North America.

Synonymy : ? Prionodon obvelatus Valenciennes, in Webb & Berholt, 1844; ? Galeolamna greyi Owen, 1853; Carcharias macrurus Ramsay & Ogilby, 1887; Galeolamna (Galeolamnoides) eblis Whitley, 1944; Carcharhinus iranzae Fourmanoir, 1961; Carcharhinus obscurella Deng, Xiong & Zhan, 1981.

Other Scientific Names Recently in Use : Carcharhinus lamiella (not Carcharias lamiella Jordan & Gilbert, 1882, equals C. brachyurus); Galeolamna macrurus (Ramsay & Ogilby, 1887).

FAO Names : En - Dusky shark; Fr - Requin sombre; Sp - Tiburón arenero.





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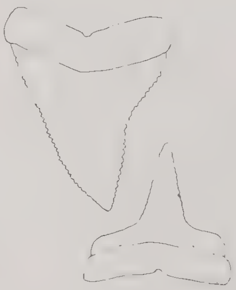
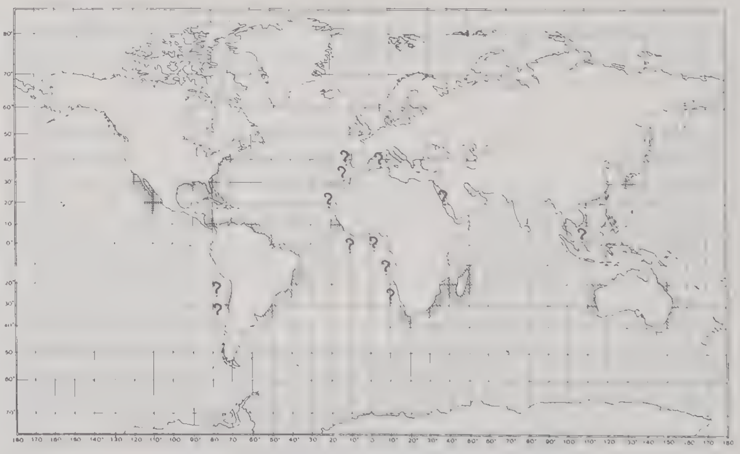


upper and lower tooth

Field Marks : A large grey shark with a fairly short, broadly rounded snout, low anterior nasal flaps, fairly large eyes, broad, triangular, rather low, erect and semioblique-cusped serrated anterolateral teeth without cusplets in upper jaw, lower teeth erect and narrow-cusped, usually 14/14 rows of anteroposterior teeth, a low interdorsal ridge, large falcate pectoral fins, a moderate-sized first dorsal with a short rear tip and origin about opposite free rear tips of pectoral fins, a small, low second dorsal, and no conspicuous markings on fins.

Diagnostic Features : A fairly slender species (up to about 3.7 m). Snout short to moderately long and broadly rounded; internarial width 1 to 1.4 times in preoral length; eyes circular and moderately large, their length 1 to 2.1% of total length; anterior nasal flaps low and poorly developed; upper labial furrows short and inconspicuous; hyomandibular line of pores just behind mouth corners not conspicuously enlarged; gill slits moderately long, third 2.7 to 4% of total length and less than a third of first dorsal base; usually 14/14 rows of anteroposterior teeth in each jaw half but varying from 14 to 15/13 to 15; upper teeth with broad, triangular, strongly serrated, rather low erect to slightly oblique cusps, that smoothly merge into crown feet which have slightly coarser serrations but no cusplets; lower teeth with erect, moderately broad, serrated cusps and transverse or sometimes arched roots. A low interdorsal ridge present. First dorsal fin moderate-sized and semifalcate, with a pointed or narrowly rounded apex and posterior margin curving ventrally from fin apex; origin of first dorsal fin usually over or slightly anterior to the pectoral free rear tips; inner margin of first dorsal moderately short, a third of dorsal base or less; second dorsal fin small and low, its height 1.5 to 2.3% of total length, its inner margin fairly long and 1.6 to 2.1 times its height; origin of second dorsal about over anal origin; pectoral fins large and falcate, with narrowly rounded or pointed apices, length of anterior margins about 17 to 22% of total length; 173 to 194 total vertebral centra, 86 to 97 precaudal centra. Tips of most fins dusky but not black or white. An inconspicuous white band on flank.

Geographical Distribution : Western Atlantic: Southern Massachusetts and Georges Bank to Florida, Bahamas, Cuba, northern Gulf of Mexico, and Nicaragua; southern Brazil. Eastern North Atlantic: ? Portugal, ? Spain, ? Morocco, ? Madeira, ? western Mediterranean, Canary and Cape Verde Islands, Senegal, Sierra Leone. Western Indian Ocean: South Africa, Mozambique, Madagascar, ? Red Sea. Western Pacific: Japan, China, Viet Nam, Australia (New South Wales, Queensland, Western Australia), New Caledonia. Eastern Pacific: Southern California to Gulf of California, Revillagigedo Islands, possibly Chile.



Habitat and Biology : A common, coastal-pelagic, inshore and offshore warm-temperate and tropical shark of the continental and insular shelves and oceanic waters adjacent to them, that ranges from the surf zone to well out to sea and from the surface to 400 m depth. It does not prefer areas with reduced salinities and tends to avoid estuaries. Adults of the species occupy an overlapping intermediate offshore coastal habitat between other similar species of Carcharhinus such as more strictly inshore coastal species such as C. plumbeus, the offshore deep-benthic C. altimus, oceanic species such as C. falciformis and C. longimanus, and island species such as C. albimarginatus and C. galapagensis. Adult dusky sharks are often seen offshore and commonly follow ships.

This shark is strongly migratory in temperate and subtropical areas in the eastern North Pacific and western North Atlantic, moving north during the warmer months of summer and retreating south when the water cools. Off the southern coast of Natal, South Africa a nursery area occurs, where newborn sharks of 80 to 90 cm are resident; larger immature sharks over 90 cm move out of this area, with females tending to move north and males south, but there is some overlap in this partial sexual segregation. This pattern is complicated by seasonal, temperature-related migrations as elsewhere in the range of these sharks, going southward in spring and summer and northward in winter, and also a tendency for the sharks to move into deeper water during cooler months. Additionally, there may be other factors affecting the distribution of these young sharks, as may be true off Durban, South Africa, where they move into the surf zone in spring and summer and move offshore in autumn and winter, although inshore water temperatures are about the same. Still larger immature sharks up to 220 cm long may move south to southern Natal, but when they become adolescent at up to 280 cm, they tend to move north of Natal along with adults into waters of southern Mozambique. The young form large feeding schools or aggregations.

Viviparous, with a yolk-sac placenta; number of young per litter 3 to 14, with South African sharks averaging more young (about 10) than those from Florida; sex ration approximately 1:1 in the fetuses of South African and Floridian sharks, and the same for adults in Florida. There may be no correlation between maternal size and litter size in this shark, unlike some other species of Carcharhinus. Birth may occur over a long time span of several months in a given region, and has been reported as occurring from late winter to summer. In South African waters birth may occur year-round with an increase in autumn. In pregnant female sharks caught off Florida in the winter there are two size-classes of young, those 43 to 70 cm and full or near full-term fetuses of 85 to 100 cm. These classes may indicate either biannual staggered birth seasons with a gestation period of 8 or 9 months or a long gestation period of about 16 months. Whatever the case, females apparently mate in alternate years; mating in the western Atlantic occurs in the spring. Females move inshore to drop their young, then depart the nursery area. Adults may mature at an age of about 6 years and live to at least 18 years. The young are readily kept in aquaria.

Dusky sharks eat a wide variety of reef, bottom, and pelagic bony fishes, including sardines, menhaden and herring, anchovies, eels, lizardfish, cuskeels, needlefish, mullet, barracuda, goatfish, groupers, porgies, grunts, croakers, bluefish, spadefish, jacks, hairtails, mackeral, tunas and spanish mackeral, soles, flounders and other flatfishes, flatheads, and gurnards, as well as angelsharks, sawsharks, spiny dogfish (Centrophorus and Squalus), catsharks (Halaelurus), smooth-hounds (Mustelus), other grey sharks (C. limbatus and C. brevipinna), skates, butterfly rays, crabs, lobsters, shrimp, octopi, cuttlefish, squid, starfish, barnacles, bryozoans, whale meat, and occasional garbage. Unlike the bull (C. leucas) and tiger (Galeocerdo cuvier) sharks mammalian carrion, oddities and garbage are apparently uncommon items in the diet of this species.

The dusky shark is apparently dangerous to people, although very few attacks by it have been recorded, and very little is known of its behaviour in relation to divers, swimmers or surfers. Because of its large size when adult, it should be considered a potential hazard where it occurs. Some attacks on people off islands such as Bermuda that were attributed to this species were probably caused by the closely similar Galapagos shark, (Carcharhinus galapagensis).

Young dusky sharks are readily preyed on by other big sharks, including sandtiger (Eugomphodus), great white (Carcharodon), bull (Carcharhinus leucas), and tiger (Galeocerdo) sharks, which help to regulate the population size of this species. Reduction of these species off Natal, South Africa through an efficient shark gillnetting programme to protect bathing beaches has apparently resulted in an increase in juvenile dusky sharks there.

Size : Maximum size possibly over 400 cm, males maturing at about 280 cm and reaching at least 340 cm; females maturing between 257 and 300 cm and reaching at least 365 cm; size at birth 69 to 100 cm.

Interest to Fisheries : A common offshore shark regularly caught with longlines, also hook-and-line and set bottom nets. It is utilized fresh, dried salted, frozen and smoked for human consumption; hides used for leather; fins for shark-fin soup base; and liver oil extracted for vitamins.

Literature : Bigelow & Schroeder (1948); Springer (1960, 1963); Garrick & Schultz (1963); Randall (1963); Clark & von Schmidt (1965); Garrick (1967, 1982); Bass, D'Aubrey & Kistanasamy (1973); Compagno & Vergara (1978); Compagno (1981); Cadenat & Blache (1981); Van der Elst (1981).

Remarks : Some records of this species from Madeira and the Mediterranean Sea may be based on C. galapagensis, according to Garrick (1982).

Carcharhinus perezi (Poey, 1876)

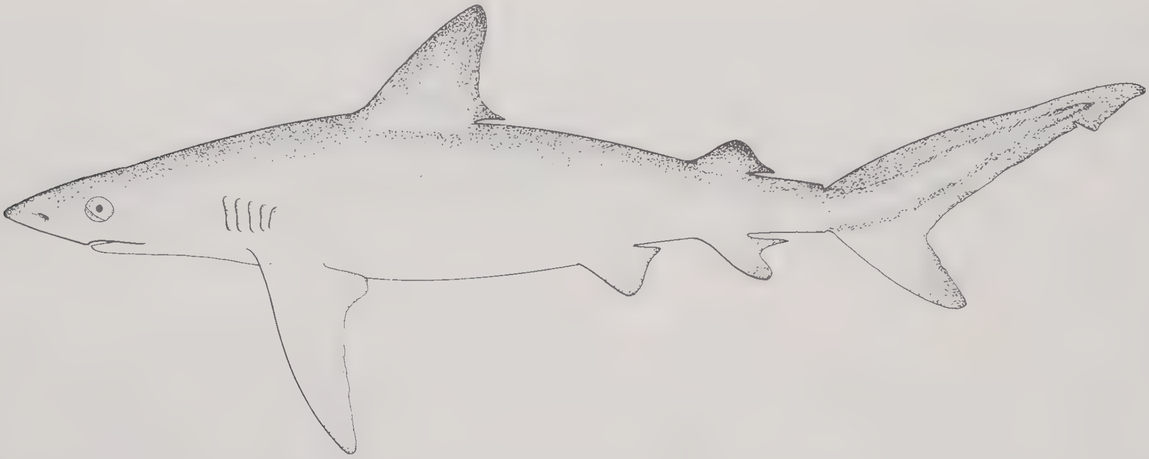
CARCH Carch 10

Platypodon perezi Poey, 1876, Ann.Soc.Esp.Hist.Nat.Madrid, 5:194, pl. 14, fig. 2-3. Holotype: Six original specimens, from 780 to 1300 mm and ca 2 m, extant? Type Locality: Cuba.

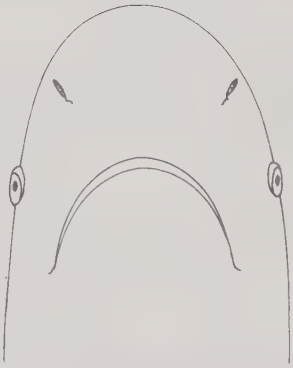
Synonymy : Eulamia springeri Bigelow & Schroeder, 1944.

Other Scientific Names Recently in Use : Carcharhinus springeri (Bigelow & Schroeder, 1944).

FAO Names : En - Caribbean reef shark; Fr - Requin de récif; Sp - Tiburón coralino.



Field Marks : A large reef-living grey shark with short, bluntly rounded snout, narrow and semierect to oblique-cusped, serrated upper anterolateral teeth without cusplets, lower teeth with erect serrated cusps, usually 13/12 rows of anterolateral teeth, an interdorsal ridge, large narrow pectoral fins, a small first dorsal with a short rear tip and a moderately large second dorsal with a short rear tip, and no prominent markings on fins.



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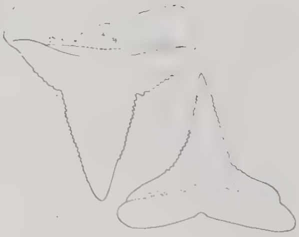
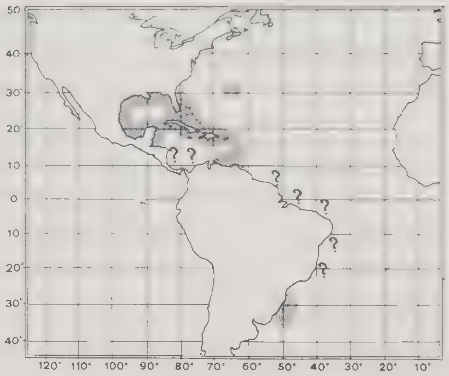


upper and lower tooth

Diagnostic Features : A fairly stocky species (up to nearly 3 m). Snout moderately short and broadly rounded; internarial width 1 to 1.1 times in preoral length; eyes circular and moderately large, their length 1.2 to 2.5% of total length; anterior nasal flaps low and poorly developed; upper labial furrows short and inconspicuous; hyomandibular line of pores just behind mouth corners not conspicuously enlarged; gill slits moderately long, the third 2.8 to 4% of total length and less than half of first dorsal base; usually 13/12 rows of anteroposterior teeth in each jaw half but varying from 12 to 13/11 to 12; upper teeth with narrow, strongly serrated, semierect to oblique, high cusps, and crown feet with slightly coarser serrations but no cusplets; lower teeth with erect, narrow finely serrated cusps and transverse or weakly arched roots. A low interdorsal ridge present. First dorsal fin moderately large and falcate, with a pointed or narrowly rounded apex and posterior margin curving ventrally or anteroventroposteriorly from fin apex; origin of first dorsal fin over or slightly anterior to pectoral free rear tips; inner margin of first dorsal moderately long, about a third of dorsal base; second dorsal fin fairly large and high, its height 2.9 to 3.2% of total length, its inner margin short and 1.1 to 1.5 times its height; origin of second dorsal over or slightly anterior to anal origin; pectoral fins moderately large, falcate, with narrowly rounded or pointed apices, length of anterior margins about 20 to 22% of total length; 208 to 213 total vertebral centra, 103 to 108 precaudal centra. Colour dark grey or grey-brown above, white below, undersides of paired fins, anal and ventral caudal lobe dusky but fins not prominently marked; white band not conspicuous on flanks.



Geographical Distribution : Western Atlantic: Florida, Bermuda, northern Gulf of Mexico and Caribbean Sea including Yucatan, Mexico, Cuba, Jamaica, Bahamas Virgin Islands, Puerto Rico, Venezuela, and southern Brazil.

Habitat and Biology : This is the commonest shark associated with coral reefs in the Caribbean, a tropical inshore bottom-dwelling species of the continental and insular shelves, at depths down to at least 30 m. It is often found near dropoffs on the outer edges of reefs. It is capable of lying on the bottom motionless, with its pharynx and gills evidently capable of pumping adequate water for respiration, and has been found lying in caves. Despite its abundance, it is poorly known.

Eats bony fishes, including bigeyes (Priacanthidae). A dangerous shark, being definitely implicated in an abortive attack on a pair of divers in the Caribbean.

Size : Maximum about 295 cm, maturity at about 152 to 168 cm, adult females 200 to 295 cm; size at birth below 73 cm.

Interest to Fisheries : A common Caribbean shark primarily fished with longlines and utilized dried salted for human consumption; hides are used for leather, oil from its liver, and fishmeal from carcasses.

Literature : Bigelow & Schroeder (1948); Springer (1960); Limbaugh (1963); Randall (1963, 1967, 1968); Böhlke & Chapin (1968); Garrick (1967, 1982); Compagno & Vergara (1978).

Carcharhinus plumbeus (Nardo, 1827)

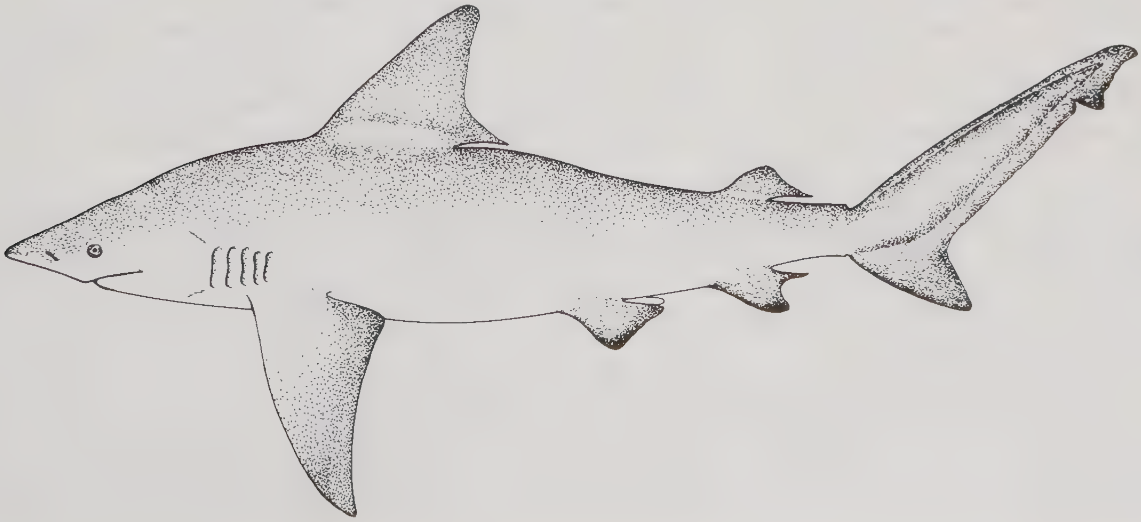
CARCH Carch 11

Squalus plumbeus Nardo, 1827, *Isis*, 20(6):477, 483. Holotype: No type material. Type Locality: Adriatic Sea.

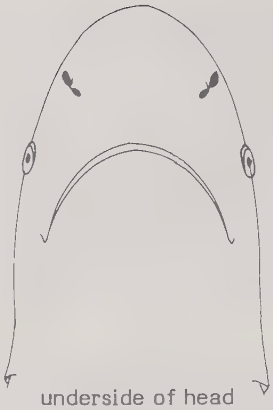
Synonymy : *Carcharias (Prionodon) milberti* Valenciennes, *in* Müller & Henle, 1839; *Carcharias ceruleus* DeKay, 1842 (not *Squalus (Carcharhinus) caeruleus* Blainville, 1825 = *Prionace glauca*); *Lamna caudata* DeKay, 1842; *Squalus caecchia* Nardo, 1847; *Carcharias (Prionodon) japonicus* Schlegal, 1850; *Carcharias obtusirostris* Moreau, 1881; *Carcharias stevensi* Ogilby, 1911; *Carcharias latistomus* Fang & Wang, 1932; *Galeolamna dorsalis* Whitley, 1944.

Other Scientific Names Recently in Use : *Carcharhinus milberti* (Valenciennes, *in* Müller & Henle, 1839); *Eulamia milberti* (Valenciennes, *in* Müller & Henle, 1839); *Galeolamna stevensi* (Ogilby, 1911); *Carcharhinus japonicus* (Schlegal, 1850); *Carcharhinus bleekeri* (not *Carcharias (Prionodon) bleekeri* Dumeril, 1865 equals *C. sorrah*); *Carcharhinus platyodon* (not *Squalus platyodon* Poey, 1861 equals *C. leucas*).

FAO Names : En - Sandbar shark; Fr - Requin gris; Sp - Tiburón trozo.



Field Marks: A medium-sized grey shark with short rounded snout, an extremely tall triangular first dorsal fin with its origin over or anterior to the pectoral insertions, broad- and high-cusped, triangular serrated upper teeth without cusplets, usually 14/13-14 rows of anterolateral teeth, an interdorsal ridge, large pectoral fins, a moderately large second dorsal with a short rear tip, and no conspicuous markings on fins.



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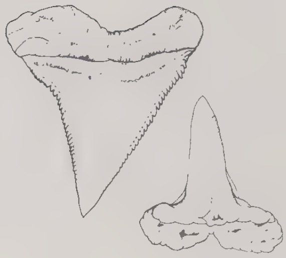
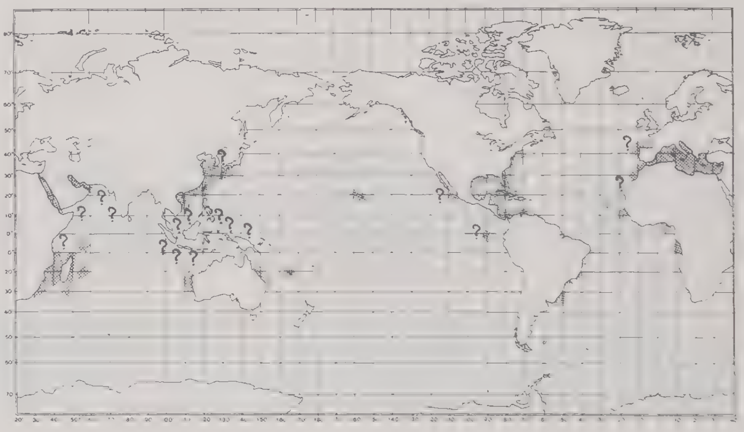


upper and lower tooth

Diagnostic Features: A fairly stocky species (up to about 2.4 m, but mostly smaller). Snout short and broadly rounded or broadly parabolic; internarial width 0.9 to 1.3 times in preoral length; eyes circular and moderately large, their length 1.7 to 2.9% of total length; nostrils with very short, low, poorly developed anterior nasal flaps; upper labial furrows short and inconspicuous; hyomandibular line of pores just behind mouth corners not conspicuously enlarged; gill slits short, third 2.4 to 3.6% of total length and less than a third of first dorsal base; usually 14/13 to 14 rows of anteroposterior teeth in each jaw half but varying from 14 to 15/12 to 15; upper teeth with broadly triangular, strongly serrated, semierect to slightly oblique cusps, merging smoothly into crown feet with slightly coarser serrations but no cusplets; lower teeth with erect, narrow serrated cusps and transverse roots. A narrow interdorsal ridge present. First dorsal fin very large and semifalcate, with pointed or narrowly rounded apex and posterior margin curving ventrally from fin apex; origin of first dorsal fin over or slightly anterior to pectoral insertions; inner margin of first dorsal moderately long, 2/5 of dorsal base, or slightly less; second dorsal fin moderately high, its height 2.1 to 3.5% of total length, its inner margin short and 1 to 1.6 times its height; origin of second dorsal over or slightly anterior to anal origin; pectoral fins large, semifalcate, with narrowly rounded or pointed apices, length of anterior margins about 17 to 22% of total length; 152 to 189 total vertebral centra, 82 to 97 precaudal centra. Colour grey-brown above, white below; tips and posterior edges of fins often dusky, but no conspicuous markings; an inconspicuous white band on flank.

Geographical Distribution: Western Atlantic: Southern Massachusetts to Florida, northern and western Gulf of Mexico, Bahamas, Cuba, Nicaragua, Costa Rica, Venezuela, southern Brazil. Eastern Atlantic: Mediterranean Sea, Portugal, ? Canary Islands, ? Spain, Morocco, Senegal, Cape Verde Islands, Gulf of Guinea, Zaire. Western Indian Ocean: South Africa, Madagascar, Mozambique, Tanzania, Mauritius, Seychelles, Red Sea, the "Gulf", Gulf of Oman. Western Pacific: Viet Nam, China (including Taiwan Province), Japan, ? the Koreas, Indonesia (Aru Island), Australia (Queensland, Western Australia), New Caledonia. Central Pacific: Hawaiian Island. ? Eastern Pacific: Galapagos and Revillagigedo Islands.



Habitat and Biology: An abundant, inshore and offshore, coastal-pelagic shark, of temperate and tropical waters, found on continental and insular shelves and in deep water adjacent to them, and oceanic banks; common at bay mouths, in harbours, inside shallow muddy or sandy bays, and at river mouths, but tends to avoid sandy beaches and the surf zone, coral reefs and rough bottom, and the surface. Depths range from the intertidal in water barely deep enough to cover it to 280 m depth. Although common in inshore environments, it does not ascend rivers into fresh water. It favours the bottom, and normally is not seen at the surface unless travelling in water so shallow that its large first dorsal fin comes out of the water.

As with several other wide-ranging carcharhinids, this species has a number of allopatric populations in different areas. In the western Atlantic Springer (1960) suggested that there are two stocks or subpopulations of sandbar sharks, a northern major one from the US Atlantic seaboard to the Gulf of Mexico and the eastern Caribbean, and a minor South American one from Trinidad eastward and southward to Brazil. Although this remains to be proven by tagging, Springer hypothesized that the separate eastern Atlantic population of this shark was capable of contributing to the South American population via migration with the equatorial current across the Atlantic.

This species has an annual migration cycle along the western North Atlantic seaboard of the United States, heading south for the winter and north for the summer. Seasonal temperature changes apparently are a prime cause of these migrations, but they are strongly influenced by the pattern of currents and locally by upwelling. Although young on nursery grounds form mixed-sex schools, adults are usually segregated. When engaged in southward migrations, males migrate earlier and deeper than females. Southward-migrating sharks often travel in large schools. Off South Africa a similar southward migration in spring and summer and northward movement in winter appears to occur. Off the Hawaiian Islands these sharks are apparently year-round residents. Preferred temperatures in shallow water off Madagascar are 23° to 24°C; off the Hawaiian Islands these sharks occur in waters 24° to 27°C.

Viviparous, with a yolk-sac placenta; number of young 1 to 14 per litter, with 5 to 12 common. Litter size varies directly with size of the mother, and in populations with smaller adults the litter size averages smaller. The size of young at birth varies considerably among different allopatric populations of this shark, including adjacent ones in the western Atlantic, as does the size attained by adults. In this shark as in many other carcharhinids, the size range of adults is relatively narrow, indicating virtually determinate growth after maturity. The gestation period is estimated as 8 to 12 months, commonly 9 months off Florida, and 11 to 12 months off South Africa and in the South China Sea. Females may give birth every other year at most. Young are born at a ratio of 1:1, but in the western Atlantic off the US southeastern seaboard adult females far outnumber males by 5 or 6:1. However, only about 17 to 27% of adult females are gravid, which may be a reflection of the apparent scarcity of males but might be due to some other factor. Off the Hawaiian Islands such inbalances in sexes apparently do not occur, and about 42% of adult females are gravid. In the western North Atlantic pupping grounds are found in temperate waters, in shallow bays and estuaries of the east-central USA, into which gravid females come to drop their young in summer (June to August). Off Senegal in the eastern Atlantic young are born in April. Females are thought to be inhibited from feeding when they give birth and shortly afterwards, and leave the pupping grounds soon after giving birth. The young inhabit shallow coastal nursery grounds during the summer and move offshore into deeper, warmer water in winter. These nursery grounds are separate from the ordinary ranges of adults, except for females arriving to drop their young and shortly departing after doing so, which probably protects the young from cannibalism. Mating occurs in the spring and summer in various populations. The males apparently follow and bite the female in the back until they swim upside down, then mate with both claspers. Mating wounds are apparent on females during the mating season.

In captivity these sharks show growth rates that suggest maturation in as little as three years, but other estimates based on tooth replacement suggests 10 years for males and 13 for females. Springer (1960) suspected that sandbar sharks may mature in only two years, but on little real evidence. Presumably maturation time is somewhere between 3 and 10 years.

The sandbar shark is primarily a predator on relatively small bottom fishes, with some molluscs and crustaceans taken. Its diet includes sardines, shad, menhaden, anchovies, sea catfishes, moray and snake eels, pipefish, barracuda, mullets, goatfishes, hairtails, spanish mackeral, bonito, mackeral, jacks, groupers, croakers, grunts, porgies, flounders and soles, sea robins, toadfish, cusk eels, porcupine fish, sharpnose sharks (Rhizoprionodon), spiny dogfish (Squalus), bonnethead sharks, guitarfish, skates, stingrays, cow-nosed rays, squid, cuttlefish, octopi, bivalves and conchs, amphipods, shrimp and crabs. It does not consume garbage and mammalian carrion as a rule, unlike some other members of its genus. Evidence from fisheries indicates that very fresh fish bait is greatly preferred by these sharks to stale or even fresh-frozen fish, and fish greatly preferred to mammalian meat. These sharks feed by day and night, more actively at night. It is thought that this shark is far more successful in obtaining a regular supply of food than larger carcharhinids such as Galeocerdo cuvier, Carcharhinus leucas and Carcharhinus obscurus; this is reflected in greater number of sandbar sharks with full or nearly full stomachs, and liver weight, which shows much less fluctuation in sandbar sharks than in the three larger species. Data from captive individuals suggests that digestion is relatively rapid, and prey is largely digested after two days.

Although relatively large and common, and with large, triangular teeth, this species has never been indicted in attacks on people, and is thought to be not particularly dangerous because of its strong preference for live fish and invertebrate prey. It is thought that adult sandbar sharks are rarely eaten by other larger sharks and may be difficult prey for them (with the likely exception of the great white shark, which is known to eat adults of this species), but that the young are readily taken by other sharks, particularly the bull and tiger sharks, which feed on them in inshore areas.

Size : Maximum possibly to 3 m but otherwise to 239 cm or less for adults; males maturing at 131 to 178 cm and reaching 224 cm; females maturing at 144 to 183 cm and reaching 234 cm; size at birth 56 to 75 cm.

Interest to Fisheries : This is an abundant inshore and offshore species where it occurs, and forms an important object of fisheries especially in the western North Atlantic, eastern North Atlantic, and South China Sea. It is caught with longlines, hook-and-line, and set bottom nets and is also fished with rod and reel by sports anglers as a game fish. It is utilized fresh, fresh-frozen, smoked and dried salted for human consumption; the hides are prized for leather and other products; the fins are prepared as the base for shark-fin soup; and the liver is extracted for oil (rich in vitamins).

Literature : Bigelow & Schroeder (1948); Springer (1960, 1963, 1967); Garrick & Schultz (1963); Cadenat (1957); Fourmanoir (1961); Wheeler (1962); Clark & von Schmidt (1965); Garrick (1967, 1982); Taniuchi (1971); Wass (1973); Bass, D'Aubrey & Kistnasamy (1973); Cadenat & Blache (1981).

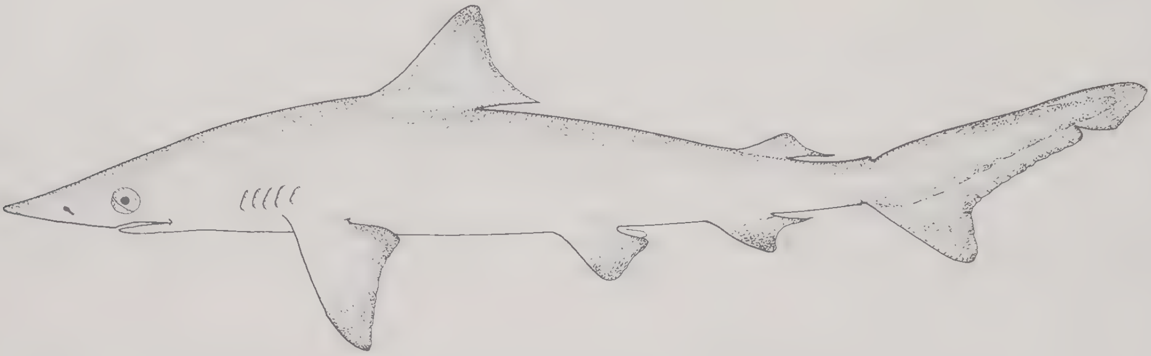
Carcharhinus porosus (Ranzani, 1839)

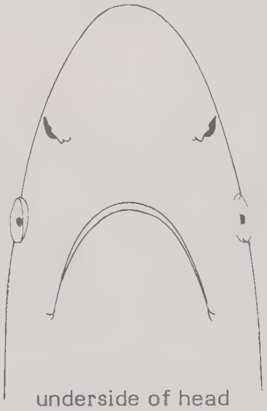
CARCH Carch 12

Carcharias porosus Ranzani, 1839, Acad.Sci.Inst.Bononiensis, Nov.Comm., 4:70, pl. 9, figs 1-3. Holotype: Male of 1170 mm, presumably adult, lost? Type Locality: Brazil.

Synonymy : Carcharias (Prionodon) henlei Valenciennes, in Müller & Henle, 1839; Carcharhinus cerdale Gilbert, in Jordan & Evermann, 1898.

FAO Names : En - Smalltail shark; Fr - Requin tiqueue; Sp - Tiburón poroso.





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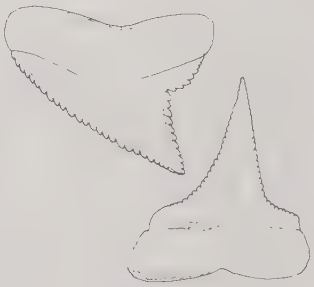
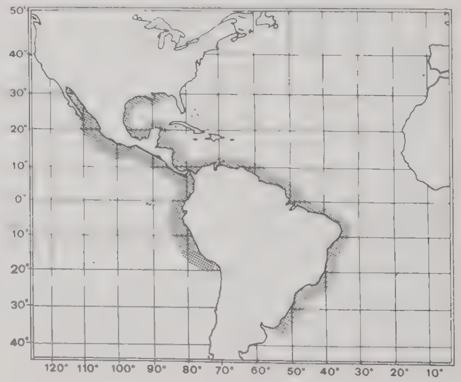


upper and lower tooth

Field Marks : A small grey shark with second dorsal small and with origin over anal midbase, anal base without long preanal ridges, labial furrows short, hyomandibular pores not conspicuous, snout long and pointed, small pectoral fins, anal fin deeply notched, 14 to 15 rows of anteroposterior teeth in each side of both jaws.

Diagnostic Features : A small slender species (less than 1.5 m). Snout moderately long and moderately pointed; internarial width 1.2 to 1.8 times in preoral length; eyes circular and large, their length 1.6 to 2.5% of total length; anterior nasal flaps expanded as slender, pointed lobes; upper labial furrows short and inconspicuous; hyomandibular line of pores just behind mouth corners not conspicuously enlarged; gill slits short, the third 2.8 to 3.4% of total length and a third or less of first dorsal base; usually 14 to 15/14 to 15 rows of anteroposterior teeth in each jaw half but varying from 13 to 15/13 to 15; upper teeth with narrow, strongly serrated, semierect to oblique, high cusps, and crown feet with slightly coarser serrations and postlateral cusplets; lower teeth with semierect or oblique, narrow serrated cusps and transverse roots. No interdorsal ridge. First dorsal fin large and falcate, with bluntly pointed apex and posterior margin curving ventrolaterally from fin apex; origin of first dorsal fin usually over the pectoral inner margins but sometimes slightly posterior to pectoral insertion; inner margin of first dorsal moderately long, half of dorsal base or slightly less; second dorsal fin moderate-sized and fairly low, its height 2.2 to 2.8% of total length, its inner margin moderately long and 1.4 to 1.9 times its height; origin of second dorsal over or slightly behind anal midbase; pectoral fins small, falcate, with narrowly rounded or pointed apices, length of anterior margins about 13 to 16% of total length; 96 to 135 total vertebral centra, 41 to 61 precaudal centra. Colour grey above, light below, tips of pectoral, dorsal and caudal fins frequently dusky or blackish, but not conspicuously marked; white flank band inconspicuous.



Geographical Distribution : Western Atlantic: Northern Gulf of Mexico coastally to southern Brazil, not in Caribbean Islands. Eastern Pacific: Gulf of California to Peru, not at offshore islands.

Habitat and Biology : A common inshore tropical shark of the American continental shelves, found near the bottom at depths from close inshore down to at least 36 m; favours mud bottom and especially estuaries.

Viviparous, with a yolk sac placenta; number of young 2 to 7. In Brazilian waters born in late spring or summer, with a gestation period of 10 months or more. About 52% of young are males.

A harmless shark, primarily a fish-eater, that eats sardines, sea catfish, croakers, jacks, grunts, other small sharks including young hammerheads and sharpnose sharks, and shrimp.

Size : Probably not exceeding 150 cm; males maturing between 75 and 78 cm and reaching 117 cm; females mature at 84 cm or below and reaching 134 cm; size at birth between 31 and 40 cm.

Interest to Fisheries : Caught incidentally throughout its range, with longlines, and utilized fresh, fresh frozen and dried salted for human consumption; the liver is also extracted for oil (vitamins) and carcasses are used for fishmeal.

Literature : Bigelow & Schroeder (1948); Sadowsky (1967); Kato, Springer & Wagner (1967); Garrick (1982).

Remarks : Garrick (1982) noted that this species also occurs in the western Pacific, off Viet Nam (Ho Chi Minh City), Borneo (Baram) and Thailand (Bangkok).

Examination of a Borneo specimen referred by Garrick to *porosus* and Garrick's published data on the Vietnamese and Thai specimens of *porosus* strongly suggests that these specimens are not conspecific with *C. porosus*, but represent a *C. borneensis*-like species that is apparently not referable to *C. borneensis* either. These specimens may represent an undescribed small species of *Carcharhinus*.

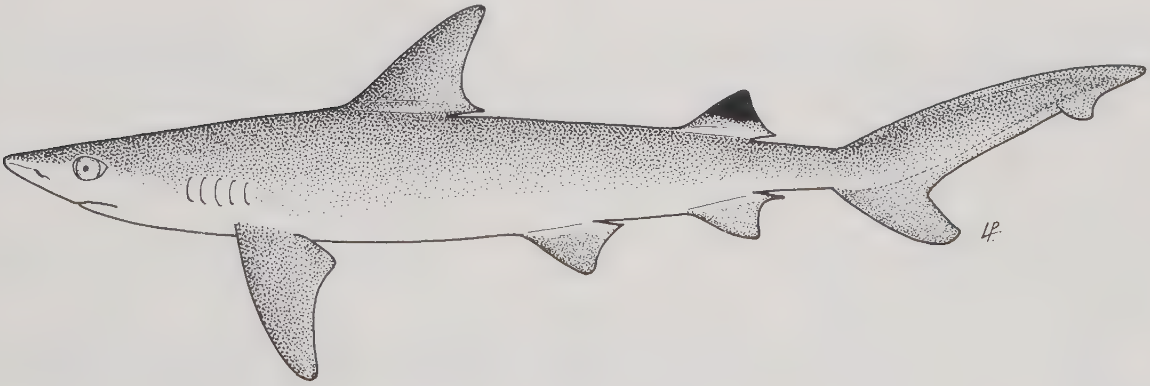
Carcharhinus sealei (Pietschmann, 1916)

CARCH Carch 24

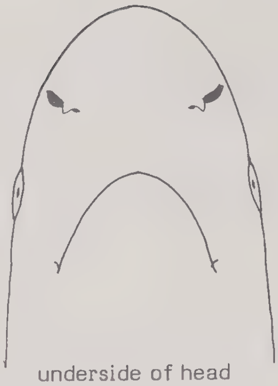
Carcharias sealei Pietschmann, 1916, *Jahrb.Nassau.Ver.Nat.*, 172, ftn pl. 1. Replacement name for *Carcharias borneensis* Seale, 1910, *Philipp.J.Sci., ser. D*, 5:263, fig. 1-4. Holotype: (*Carcharias borneensis* Seale, 1910), Bureau of Science, Manila, the Philippines, 2720 (apparently lost; Garrick, 1982). Type Locality: Sandakan, Borneo.

Synonymy : *Carcharias borneensis* Seale, 1910 (not *Carcharias* (*Prionodon*) *borneensis* Bleeker, 1859 = *Carcharhinus borneensis*); *Platypodon coatesi* Whitley, 1939.

FAO Names : En - Blackspot shark; Fr - Requin à taches noires; Sp - Tiburón alinegro.



Field Marks : A small grey shark with a moderately long rounded snout, fairly large horizontally oval eyes, a black spot on the second dorsal fin but no other markings, oblique-cusped serrated teeth in both jaws, upper teeth with strong, smooth-edged cusplets, usually 12/12 rows of anterolateral teeth, small falcate pectoral fins, a small falcate first dorsal with a short rear tip and a moderately large second dorsal with a short rear tip.



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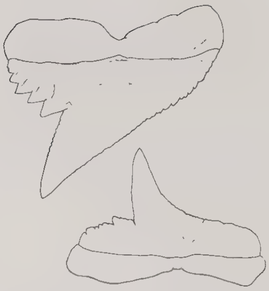
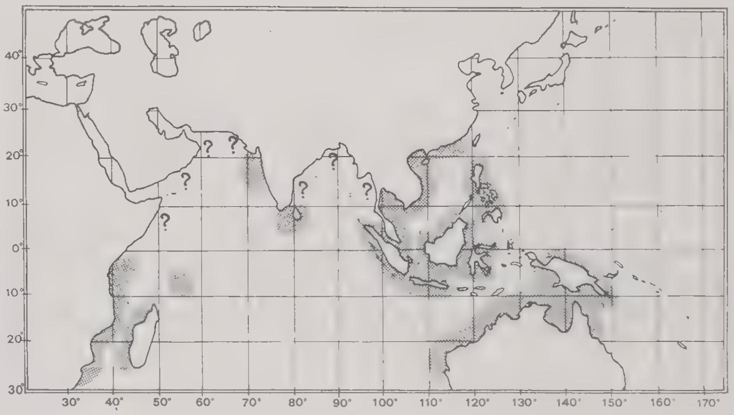


upper and lower tooth

Diagnostic Features : A usually slender species (up to about 95 m). Snout short and moderately pointed to rounded; internarial width 1.2 to 1.6 times in preoral length; eyes usually horizontally oval and moderately large, their length 2 to 2.8% of total length; anterior nasal flaps moderately elongate and broadly triangular; upper labial furrows short and inconspicuous; hyomandibular line of pores just behind mouth corners not conspicuously enlarged; usually 12/12 rows of anterolateral teeth in each jaw half but varying from 12 to 13/11 to 13; upper teeth with narrow to moderately broad, strongly serrated, strongly oblique cusps, and distal crown feet with strong, usually smooth-edged cusplets; lower teeth with oblique, serrated or smooth cusps. Interdorsal ridge present or absent. First dorsal fin small, falcate, with a pointed or narrowly rounded apex and posterior margin dropping ventrally or anteroventrally from apex; its origin usually over or slightly posterior to pectoral free rear tip; its inner margin short, about half of first dorsal base; second dorsal fin large and high, its height 2.8 to 4.3% of total length, its inner margin short and 0.8 to 1.3 times its height; origin of second dorsal slightly to noticeably behind anal fin origin; pectoral fins small, strongly falcate, and with narrow, pointed apices, length of anterior margins about 15 to 17% of total length in larger individuals (60 cm and above); 148 to 167 total vertebral centra, 74 to 85 precaudal centra. Colour grey or tan above, lighter below; a conspicuous black or dusky tip present on second dorsal fin, but other fins with pale posterior edges and no dark markings; inconspicuous light stripes on flanks.

Geographical Distribution : Indo-West Pacific: South Africa, Madagascar, Mozambique, Tanzania, Kenya, Seychelles, Mauritius, Pakistan, Sri Lanka, India, Andaman Islands, Thailand, Viet Nam, China, Sumatra, Java, Sulawesi, New Guinea, Australia (western and northern Australia, Queensland).



Habitat and Biology : A common coastal shark on the continental and insular shelves, from the surf line and intertidal region to 40 m depth, usually in shallow water. It is not found off river mouths and may be intolerant of reduced salinities. One was caught at the surface in water 1260 m deep west of Madagascar, but close to shallow water. Off Natal, South Africa this shark appears to be resident all year, with some increase in numbers during the summer.

Viviparous, with a yolk sac placenta; number of young 1 or 2 per litter. Off South Africa, young are born in spring, and the gestation period is thought to be about 9 months. Van der Elst (1981) gave a growth curve indicating that this is rather fast-growing for a shark, maturing at about a year old and reaching a maximum age of at least 5 years.

This shark eats small fishes, including sea horses, as well as squid and prawns. A small, harmless species, not known to be dangerous to people.

Size : Maximum 95 cm, males maturing at 70 to 80 cm, and reaching 95 cm, females maturing at 68 to 75 cm and reaching at least 94 cm.

Interest to Fisheries : A common inshore shark where it occurs, readily available and commonly caught by artisanal and smallscale commercial fisheries as well as sport anglers fishing from the shore. Commonly fished with line gear and gillnets off India, Pakistan, Sri Lanka and Thailand, and utilized for human consumption.

Literature : Whitley (1940); Garrick (1967, 1982); Bass, D'Aubrey & Kistnasamy (1973); Van der Elst (1981).

Remarks : The present species has often been confused with C. dussumieri, and has often been listed under its name or its synonym C. tjutjot, or C. menisorrah.

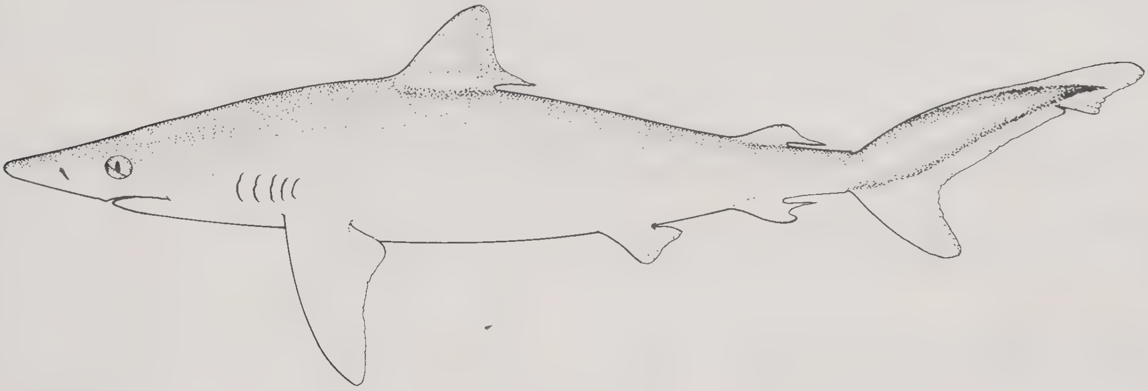
Carcharhinus signatus (Poey, 1868)

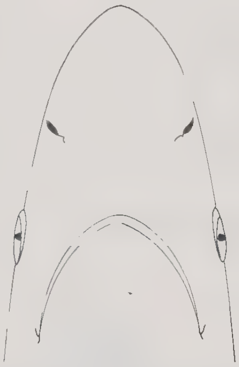
CARCH Carch 13

Hypoprion signatus Poey, 1868, Repert.fisico-nat.Isla Cuba, 2:452, pl. 4, fig. 7-8. Holotype: ?. Type Locality: Cuba.

Synonymy : Hypoprion longirostris Poey, 1876; Hypoprion bigelowi Cadenat, 1956.

FAO Names : En - Night shark; Fr - Requin de nuit; Sp - Tiburón nocturno.





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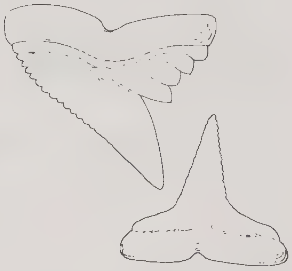
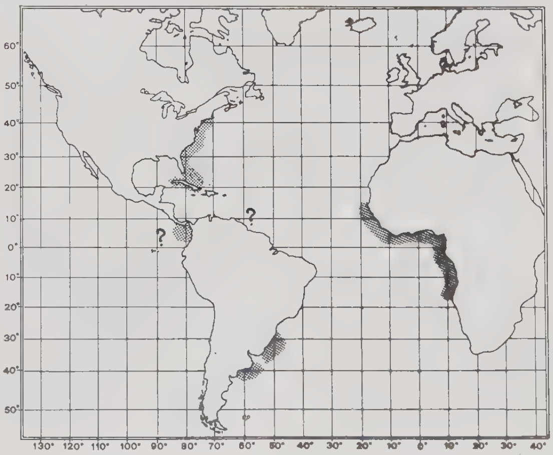


upper and lower tooth

Field Marks : A large grey shark with a long pointed snout, large eyes, oblique-cusped upper anterolateral teeth with smooth or weakly serrated cusps and strong cusplets, lower teeth with erect to semierect cusps but no cusplets, usually 15/15 rows of anterolateral teeth, an interdorsal ridge, moderate-sized pectoral fins, a small first dorsal with a moderately long rear tip and a low second dorsal with a long rear tip, and no conspicuous markings on fins.

Diagnostic Features : A fairly slender species (up to about 2.8 m). Snout very long and moderately pointed; internarial width 1.7 to 1.9 times in preoral length; eyes circular and moderately large, their length 1.8 to 2.7% of total length; upper labial furrows short and inconspicuous; hyomandibular line of pores just behind mouth corners not conspicuously enlarged; gill slits short, the third 2.5% of total length and less than a third of first dorsal base; usually 15/15 rows of anteroposterior teeth in each jaw half; upper teeth with narrow, smooth or irregularly serrated, oblique cusps, and crown feet with strong distal cusplets (young) or coarse proximal and distal serrations or weak cusplets (adults); lower teeth with erect, smooth cusps and transverse roots. Interdorsal ridge present. First dorsal fin small and triangular, with a pointed or narrowly rounded apex and posterior margin curving posteroventrally from fin apex; origin of first dorsal fin over pectoral free rear tips; inner margin of first dorsal moderately long, half of dorsal base or slightly less; second dorsal fin small and low, its height 1.7 to 2.1% of total length, its inner margin long and about 1.9 to 2.2 times its height; origin of second dorsal over or slightly posterior to anal origin; pectoral fins moderate-sized, slightly falcate, with narrowly to fairly broadly rounded apices; length of anterior margins about 17 to 18% of total length in individuals of all sizes; 184 to 192 total vertebral centra, 101 to 104 precaudal centra. Fins without conspicuous markings, sometimes small black spots scattered on body. An inconspicuous white band on flank.



Geographical Distribution : Western Atlantic: Delaware to Florida, Bahamas, Cuba, ? Guayana; southern Brazil, Argentina. Eastern Atlantic: Senegal to Ivory Coast, Ghana to Cameroon, Zaire, Angola. ? Eastern Pacific: Panama.

Habitat and Biology : A common deepwater coastal and semioceanic carcharhinid, occurring on or along the outer continental and insular shelves of the tropical and warm-temperate Atlantic. Prefers waters 50 to 100 m deep, but with considerable numbers reaching the surface and extending down to 200 m, and some occurring down to at least 600 m. The night shark is apparently a schooling species, uncommonly caught singly but often in groups; and caught at night or dawn rather than the day which indicates that it makes vertical migrations. Shows a seasonal variation in numbers off Cuba apparently as a result of geographic migrations. Recorded temperatures where it was caught off West Africa at depth of 90 to 285 m, 11° to 16°C; salinity 36°/oo; oxygen 1.81 ml/l (Poll, 1950).

Viviparous, with a yolk-sac placenta; number of young 4 to 12 per litter.

The night shark feeds mainly on small active bony fishes, including flyingfish, scombrids, butterfishes, sea basses and squid. It is apparently a relatively quick, active shark, but is not known to be dangerous to people.

Size : Maximum 280 cm, adult females recorded at 178 to 179 cm, size at birth about 60 cm.

A length-weight curve for sharks caught off Cuba is:

$$WT = 0.2998 \times 10^{-6} TL^{3.738} \text{(Guitart Manday, 1975).}$$

Interest to Fisheries : This species is primarily fished off Cuba but is also caught in the eastern Atlantic, with longlines but occasionally also pelagic trawls, and utilized for fishmeal and oil.

Literature : Bigelow & Schroeder (1948); Poll (1950); Cadenat (1956); Guitart Manday (1975); Applegate *et al.* (1979) Cadenat & Blache (1981); Raschi, Musick & Compagno (1982).

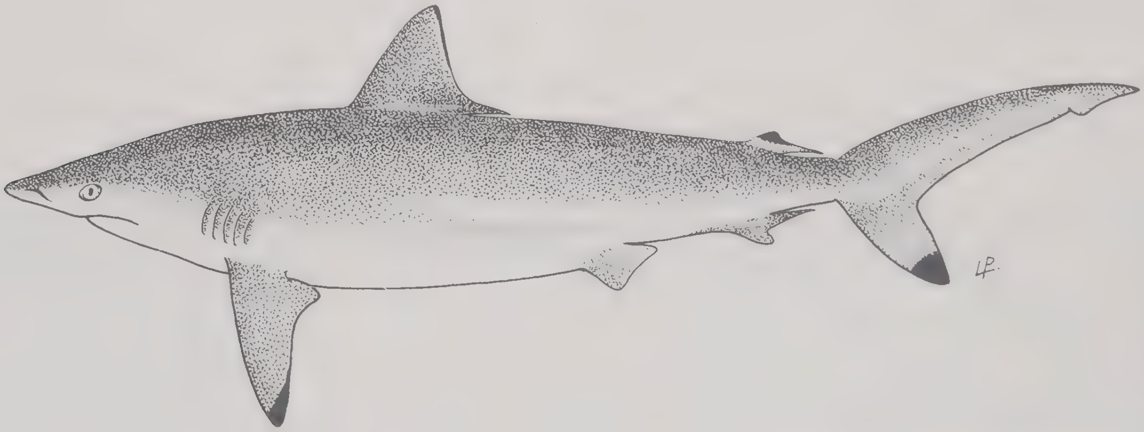
Carcharhinus sorrah (Valenciennes, 1839)

CARCH Carch 25

Carcharias (*Prionodon*) *sorrah* Valenciennes, *in* Müller & Henle, 1839, *Syst.Beschr.Plagiost.*, (2):45, pl. 16. Lectotype: Rijksmuseum van Natuurlijke Historie, Leiden, RHN 4294, 570 m female, Java, designated by Garrick (1982). Type Locality: "Indien, Java, Madagaskar".

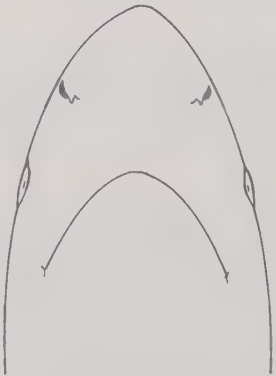
Synonymy : *Squalus spallanzani* Peron & LeSueur, *in* LeSueur, 1822 (see discussion below); *Carcharias* (*Prionodon*) *bleekeri* Dumeril, 1865; *Carcharias taeniatus* Hemprich & Ehrenberg, 1899; *Galeolamna isobel* Whitley, 1947.

FAO Names : En - Spot-tail shark; Fr - Requin à queue tachetée; Sp - Tiburón rabo manchado.



Field Marks : A small to fairly large, spindle-shaped grey shark with moderately long rounded snout, fairly large eyes, oblique-cusped serrated teeth in both jaws, upper teeth with strong cusplets, usually 12/12 rows of anterolateral teeth, an interdorsal ridge, small pectoral fins, a moderate-sized first dorsal with a short rear tip and a small, low second dorsal with a long rear tip, and conspicuous large black tips on the ventral caudal lobe, second dorsal and pectoral fins.

Diagnostic Features : A small to moderately large, fairly stocky and spindle-shaped species (up to about 1.6 m). Snout moderately long and pointed; internarial width 1.3 to 1.5 times in preoral length; eyes circular and moderately large, their length 1.7 to 2.4% of total length; anterior nasal flaps narrow, elongated and nipple-shaped;



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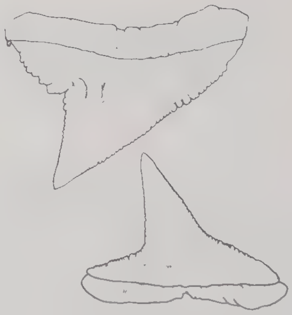
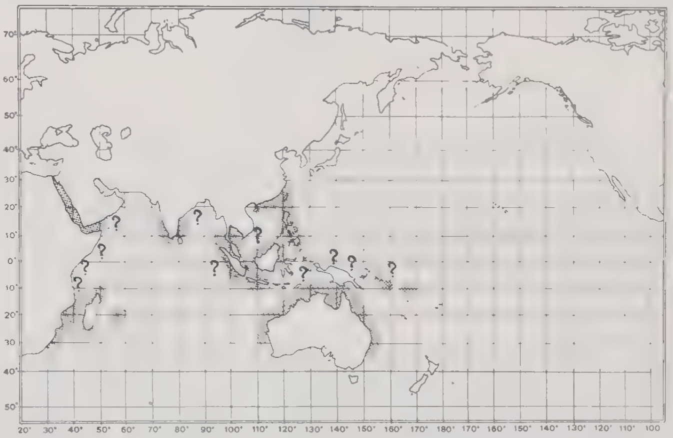


upper and lower tooth

upper labial furrows short and inconspicuous; hyomandibular line of pores just behind mouth corners not conspicuously enlarged; gill slits fairly short, the third 2.1 to 3.3% of total length and slightly less than a third of first dorsal base; usually 12/12 rows of anteroposterior teeth in each jaw half but varying from 11 to 13/11 to 12; upper teeth with narrow, strongly serrated, oblique moderately high cusps, and crown feet with coarse proximal serrations and strong distal cusplets; lower teeth with oblique narrow serrated cusps and transverse roots, but no cusplets. A low interdorsal ridge present. First dorsal fin large and falcate, with a pointed or narrowly rounded apex and posterior margin curving ventrally from fin apex; origin of first dorsal fin varying from slightly behind to slightly in front of the pectoral free rear tips; inner margin of first dorsal moderately long, slightly less than half the dorsal base; second dorsal fin small and low, its height 1.5 to 2.2% of total length, its inner margin long and 2 to 2.6 times height; origin of second dorsal 1/3 of anal base behind anal origin; pectoral fins fairly small, falcate, with narrowly rounded or pointed apices, length of anterior margins about 16 to 18% of total length; 153 to 175 total vertebral centra, 66 to 79 precaudal centra. Body medium grey above white below; a conspicuous and large black tip on the pectorals, second dorsal, and ventral caudal lobe, but first dorsal only with black edge at most; a conspicuous white band on flank.



Geographical Distribution : Indo-West Pacific: Mozambique and South Africa, Madagascar, Mauritius, Seychelles, Red Sea, Aden, southern Yemen, Pakistan, India, Sri Lanka Singapore, Java, ? Sumatra, ? Malaysia, Thailand, Viet Nam, China (including Taiwan Island), The Philippines, Australia (New South Wales, Queensland, western and northern Australia), Vanikoro Island (Santa Cruz Islands), Solomon Islands.

Habitat and Biology : A common coastal, shallow-water tropical shark of the continental and insular shelves, primarily around coral reefs at depths from the intertidal down to 73 m.

Differences in vertebral counts and litter sizes between spot-tail sharks in the Red Sea and southwestern Indian Ocean may indicate relatively isolated populations there, but this needs confirmation.

Viviparous, with a yolk-sac placenta; number of young 3 to 6 per litter, commonly 6. Off Bombay, the birth season is in spring (March to May); and possibly in summer off Madagascar. Young spot-tail sharks occur in quiet, shallow water, apart from the adults.

Eats bony fishes, including bonito and sea bass, and octopi.

Size : Maximum about 160 cm, recorded at 198 and 230 cm but possibly incorrectly; males maturing at 106 cm or below and reaching at least 128 cm, females maturing between 110 and 118 cm and reaching at least 150 cm; size at birth 45 to 60 cm.

Interest to Fisheries : A common, wide-ranging inshore shark that apparently is regularly caught by local artisanal and smallscale commercial fisheries where it occurs, including off Pakistan, Sri Lanka, India and Thailand; taken with line gear and gillnets and utilized for human consumption; probably also used for fins and liver oil.

Literature : Fowler (1941); Setna & Sarangdhar (1949); Garrick & Schultz (1963); Garrick (1967, 1982); Bass, D'Aubrey & Kistnasamy (1973).

Remarks : Garrick (1982) noted that the earliest species name for this shark was Squalus spallanzani Peron & LeSueur in LeSueur, 1822. The original description of S. spallanzani is sketchy and inadequate to establish its identity, but an unpublished and accurate drawing by LeSueur clearly does so. However, Garrick chose to retain the far better known name C. sorrah for the present species, as there is no type material for S. spallanzani, the usage of its name has been generally incorrect, and because of the inadequacy of its original description.

Carcharhinus wheeleri Garrick, 1982

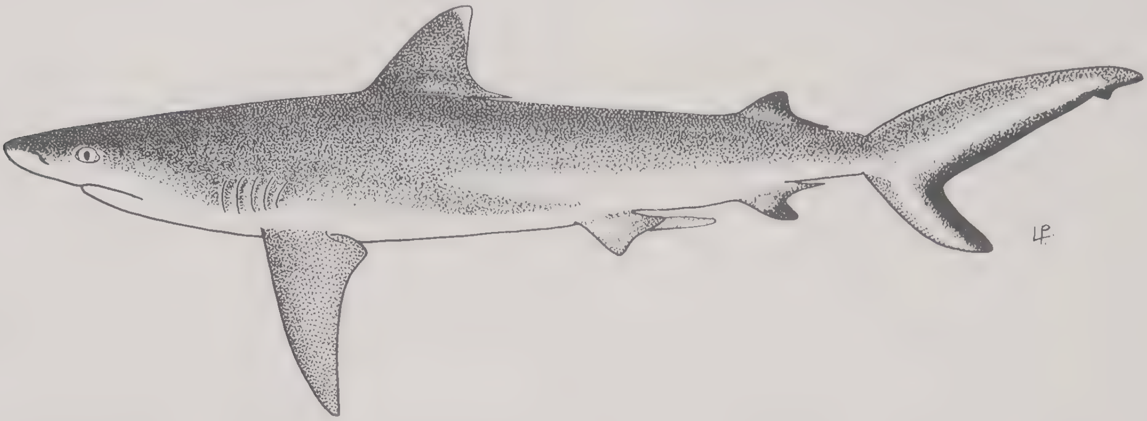
CARCH Carch 26

Carcharhinus wheeleri Garrick, 1982, U.S.Dept.Commerce, Nat.Mar.Fish.Serv.Circ., (445):111, figs 50-51. Holotype: U.S. National Museum of Natural History, USNM 197418, 1322 mm adult male. Type Locality: Red Sea.

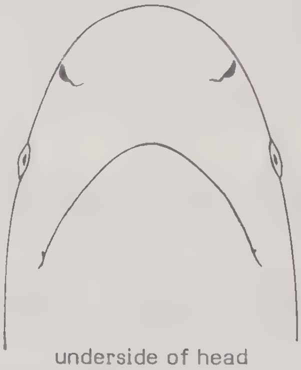
Synonymy : None.

Other Scientific Names Recently in Use : Carcharhinus spallanzani (Peron & LeSueur, in LeSueur, 1822), see discussion under Carcharhinus sorrah; Carcharhinus amblyrhynchus (Bleeker, 1856).

FAO Names : En - Blacktail reef shark; Fr - Requin à queue noire; Sp - Tiburón coralero rabinegro.



Field Marks : A medium-sized grey shark with a moderately long, broadly rounded snout, usually round eyes, no interdorsal ridge, narrow-cusped, serrated upper anteroposterior teeth, usually 13/13 on each side, white-tipped first dorsal fin, large second dorsal fin with a short rear tip, and a broad black band on the posterior margin of the caudal fin.



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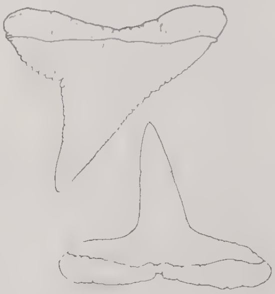
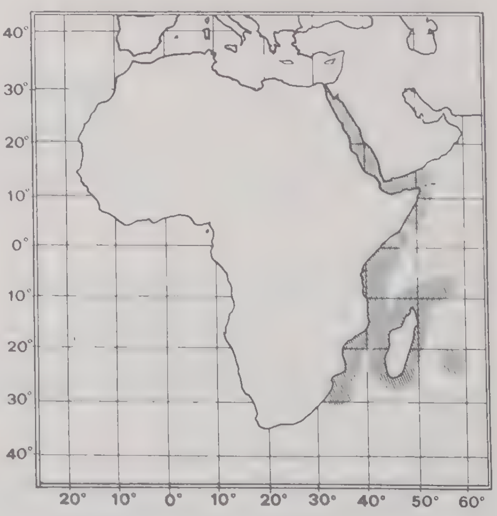


upper and lower tooth

Diagnostic Features : A fairly stocky species (to 1.7 m). Snout fairly long and broadly bluntly rounded; internarial width 1 to 1.4 times in preoral length; eyes usually round and fairly large, their length 2 to 2.9% of total length; anterior nasal flaps hardly expanded as very low triangular lobes; upper labial furrows short and inconspicuous; hyomandibular line of pores just behind mouth corners not conspicuously enlarged; gill slits moderate-sized, the third 2.5 to 3.1% of total length and less than 2/5 of first dorsal base; usually 13/13 rows of anteroposterior teeth in each jaw half but varying from 13 to 14/14 to 15; upper teeth with narrow, strongly serrated, semierect to oblique, high cusps, and crown feet with coarser serrations and often distal cusplets; lower teeth with erect or semioblique, narrow serrated cusps and transverse roots. Usually no interdorsal ridge. First dorsal fin moderate-sized and semifalcate, with a narrowly rounded or pointed apex and posterior margin curving ventrally from fin apex; origin of first dorsal fin usually over or just in front of pectoral free rear tips; inner margin of first dorsal moderately long, somewhat or less than half dorsal base; second dorsal fin moderately large and high, its height 2.8 to 4.1% of total length, inner margin fairly long and 1 to 1.5 times its height; origin of second dorsal over or slightly in front of anal origin; pectoral fins moderately large, narrow and falcate, with narrowly rounded or pointed apices, length of anterior margins about 18 to 21% of total length; 210 to 227 total vertebral centra, 110 to 117 precaudal centra. Colour grey above, white below; first dorsal with a white tip and posterior margin, entire posterior margin of caudal (terminal, pre-and postventral margins) with a conspicuous broad black band, pectorals, second dorsal, anal, and pelvic fins with blackish or dusky tips.

Geographical Distribution : Apparently confined to the western Indian Ocean, off South Africa, Madagascar, Mozambique, Tanzania, the Seychelles, Comores, and Aldabra Islands, St. Brandon Reef, Kenya, the Gulf of Aden, and the Red Sea.



Habitat and Biology : A common coastal, inshore to offshore reef shark where it occurs, from the surface and intertidal down to at least 140 m. It is common on deeper banks away from major reefs and along fringing reefs, but is occasionally found on reef flats. Younger sharks apparently live in shallower waters than adults.

Viviparous, with a yolk-sac placenta; number of young 1 to 4 per litter, with larger females having larger litters. Mating and conception, as well as birth, occurs in the winter and early spring with a gestation period of about a year.

Eats small fishes, squid and octopi. Not implicated in attacks on people, but aggressive when spearfishing activities are occurring and hence potentially dangerous.

Size : Maximum about 172 cm, possibly to 193 cm; males maturing between 110 and 130 cm and reaching at least 168 cm and possibly 193 cm; females mature at about 120 cm and reaching at least 172 cm; size at birth about 65 to 75 cm.

Interest to Fisheries : Probably relatively important to fisheries in some areas where it occurs (particularly off East Africa and in the Mauritius-Seychelles region where it is quite abundant); probably used fresh and dried salted for human consumption, and for fishmeal and other shark products.

Literature : Wheeler (1962); Bass, D'Aubrey & Kistnasamy (1973); Garrick (1982).

Remarks : This species was termed C. amblyrhynchus by Wheeler (1962) and C. spallanzani by Bass, D'Aubrey & Kistnasamy (1973), but was recently distinguished as a new species by Garrick (1982). It is very close to C. amblyrhynchos and may prove to be not distinct from that species.

Galeocerdo Müller & Henle, 1837

CARCH Gal

Genus : Galeocerdo Müller & Henle, 1837, Ber.Akad.Wiss.Berlin, 115.

Type Species : Squalus arcticus Faber, 1829, by subsequent monotypy in Bonaparte (1838:211).

Synonymy : Genus Boreogaleus Gill, 1862.

Diagnostic Features : Body fairly stout. Head broad and flat but not trowel-shaped; snout bluntly rounded or nearly truncate in dorsoventral view, very short, with preoral length about equal to internarial space and much less than mouth width; eyes fairly large, without posterior notches; large, slitlike spiracles present; no papillose gillrakers on internal gill openings; nostrils small, internarial space about 3 times the nostril width; anterior nasal flaps short, broadly triangular, and not tubular; labial furrows very long, with uppers over twice as long as lowers and nearly reaching anterior ends of eyes; teeth similar in upper and lower jaws, of characteristic cockscomb shape, with heavy, bent, oblique cusps, strong distal cusplets and prominent serrations but no blades; cusps of lower teeth not prominently protruding when mouth is closed; 18 to 26/18 to 25 rows of teeth; interdorsal ridge present and very prominent; low but prominent dermal keels present on caudal peduncle; upper precaudal pit transverse and crescentic. First dorsal origin above pectoral insertions or inner margins, its midbase closer to pectoral bases than to pelvics, and free rear tip well in front of pelvic fins; second dorsal fin much smaller than first, its height about 2/5 of first dorsal height or less; its origin slightly anterior to anal origin; pectoral fin moderately broad and semifalcate, pectoral length from origin to free rear tip about 3/5 to 2/3 of their anterior margins; pectoral origins under interspace between third and fourth gill slits; anal fin about as large as second dorsal, with short preanal ridges and a deeply notched posterior margin. Colour grey with a unique colour pattern of black spots and vertical bars on dorsal surface of body, bold in young but fading out in adults. Gigantic sharks, up to 6 and possibly 7.5 m.

Remarks : Japanese writers, including Matsubara (1955) and Shiino (1972) often recognize two species of Galeocerdo, G. cuvier and G. rayneri McDonald & Barron, 1868. Pending confirmation of the validity of G. rayneri the writer prefers to include it in synonymy of G. cuvier (see also Compagno, 1979).

Galeocerdo cuvier (Peron & LeSueur, 1822)

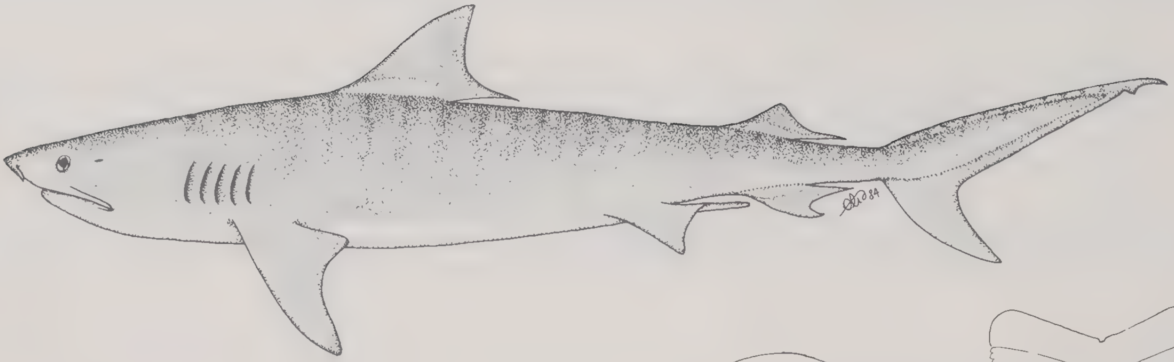
CARCH Gal 1

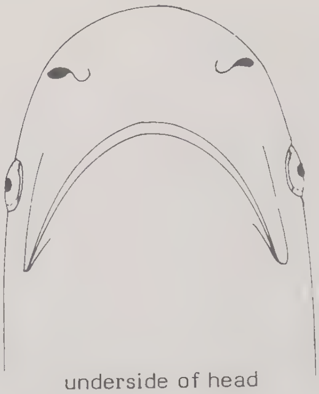
Squalus cuvier Peron & LeSueur, in LeSueur, 1822, J.Acad.Nat.Sci.Philad., 2(2):351. Holotype: None. Type Locality: Northwest coast of New Holland (Australia).

Synonymy : Squalus arcticus Faber, 1829; Galeus cepedianus Agassiz, 1838; Galeocerdo tigrinus Müller & Henle, 1839; Galeus maculatus Ranzani, 1840; Carcharias (Prionodon) fasciatus Bleeker, 1852 (in part, also based on Carcharhinus dussumieri); Galeocerdo rayneri McDonald & Barron, 1868; Galeocerdo obtusus Klunzinger, 1871; Carcharias hemprichii Hilgendorf in Hemprich & Ehrenberg, 1899.

Other Scientific Names Recently in Use : Galeocerdo arcticus (Faber, 1829).

FAO Names : En - Tiger shark; Fr - Requin tigre commun; Sp - Tintorera.





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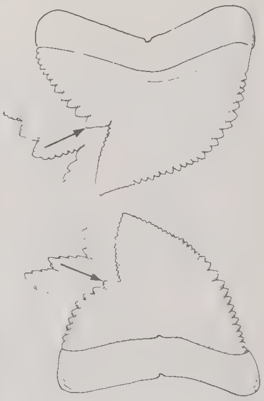
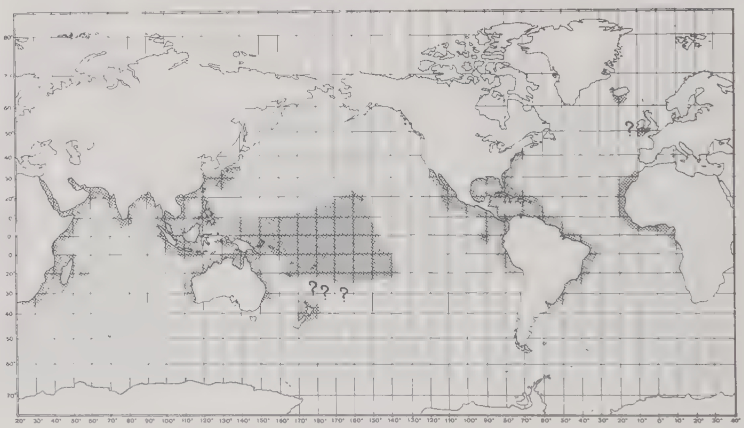


upper and lower tooth

Field Marks : A big-headed, very short and blunt-snouted, large-mouthed requiem shark with a rather slender body behind the pectoral fins, long upper labial furrows that reach the eyes, large spiracles, cockscomb-shaped curved teeth with heavy serrations and distal cusplets, low keels on caudal peduncle, a slender caudal fin with an acutely pointed tip, and characteristic dark, vertical tiger-stripe markings, faded or obsolete in adults.

Diagnostic Features : See genus.

Geographical Distribution : Circumglobal in temperate and tropical seas. Western Atlantic: Massachusetts, USA to Uruguay, including Gulf of Mexico and Caribbean islands. Eastern North Atlantic: Iceland and possibly UK (presumably as a vagrant that followed the Gulf Stream northward and so crossed the Atlantic), Morocco and Canary Islands, Senegal, Gambia, Guinea, Ivory Coast, and Ghana, but probably more wide-ranging in the area, from Morocco to Angola. Indo-West Pacific: South Africa north to the Red Sea and east to Pakistan, India, Sri Lanka, Thailand, Viet Nam, southern China (including Taiwan Province), Japan, the Philippines, Indonesia, Australia (northern, western and southern Australia, New South Wales), New Zealand, New Caledonia. Western central Pacific: Palau east to Solomon, Marshall and Hawaiian Islands, as well as Tahiti (French Polynesia). Eastern Pacific: Southern California to Peru, Cocos, Galapagos, Revillagigedo Islands.



Habitat and Biology : A common, wide-ranging coastal-pelagic tropical and warm-temperate shark, with a wide tolerance for different marine habitats, on or adjacent to the continental and insular shelves at depths from the surface and intertidal to possibly 140 m. It seems to prefer turbid areas in continental waters, large island groups or high volcanic islands where high runoff of fresh water may contribute to a high density of prey organisms. It often occurs in river estuaries, close inshore off wharves and jetties in harbours, and in coral atolls and lagoons. It is also known to make excursions far offshore, in the open ocean, but is not a truely oceanic species like Prionace and certain Carcharhinus. It does occur off oceanic islands far from other islands and continental land masses, and probably is capable of long oceanic voyages between islands.

The tiger shark is apparently nocturnal, and shows a localized diel cycle of movement inshore at night into shallow bays, estuaries, passes between islands, lagoons, and other shallow areas sometimes barely deep enough to swim in. By day the sharks retreat to deeper water off reefs and in deeper areas of bays and lagoons where they remain until nightfall. During the day, smaller tiger sharks may be more active, less timid in light, and less reluctant to approach the surface than large ones, though all sizes come to the surface at night. Although tiger sharks may form aggregations, especially when feeding, the species may be more often solitary.

Adults and subadult tiger sharks may be resident or semi-resident around oceanic islands, with movement by some individuals into or out of the area. With depletion of a resident population around such islands, smaller individuals will gradually recolonize them, probably by swimming across the open ocean. Seasonal movements have been noted for continental waters.

The tiger shark is an active, strong-swimming shark, ordinarily seen cruising slowly with a sinuous motion that has been described as 'sluggish'. When attacking or fleeing it becomes highly active, and is capable of bursts of high-speed swimming. It can be kept in aquaria, but usually does not last more than a few months.

This is the only ovoviviparous carcharhinid, but it is uncertain whether ovovivipary is primitive in the tiger shark or due to loss of the vitelline placenta. The related Hemigaleidae, the apparent sister group of the Carcharhinidae, has vivipary (placentovivipary), suggesting that the condition in the tiger shark is secondary. Pupping is reported in spring and early summer, April to June in the Northern Hemisphere, and probably November to January in the Southern. Size of litters very large, 10 to 82. The gestation period may be slightly over a year. In the Northern Hemisphere, mating may occur in the spring. This species may mature at between 4 to 6 years old and live to at least 12 years.

The tiger shark is perhaps the least specialized of sharks as far as feeding is concerned. It eats a wide variety of marine life as well as being somewhat of a 'garbage-can with fins' in its taking of carrion and all manner of inedible objects. The tiger shark is a 'sea hyena', a potent predator-scavenger that opportunistically exploits its environment. It takes a wide variety of bony fishes, including tarpon, ten-pounders, eels, sea catfish, mullet, wrasses, parrotfish, goatfish, jacks, mackeral, tongue-soles, flatheads, flying gurnards, batfish, triggerfish, porcupine fishes, boxfish, and puffers. Elasmobranch prey includes many other species of sharks, including bramble sharks, spiny dogfish, sawsharks, angel sharks, bullhead sharks, grey sharks, sharpnose sharks, hammerheads, and even other tiger sharks, as well as guitarfishes, skates, whiptail and round stingrays, butterfly rays, mantas and spotted eagle rays. It is thought by at least one writer (S. Springer) that large tiger sharks cannot readily take uninjured small sharks and bony fishes, but are extremely opportunistic in attacking hooked and netted fishes, including other sharks, and are somewhat of a problem to shark fisheries in the tropics because they do this more than other species of large sharks. However, they often manage to hook themselves after eating hooked fishes. This shark takes marine reptiles more than any other species, and frequently preys on sea turtles (green, loggerhead and ridley turtles) and is one of the most important predators on sea snakes. Presumably Galapagos marine iguanas are eaten by the tiger shark, and in one instance a large green iguana was found in a tiger shark's stomach. Sea birds, including shearwaters, frigate birds, cormorants and pelicans, are taken, along with migrating land birds that fall into the water. Marine mammals taken by the tiger shark include sea lions, fur seals, monk seals, dolphins, possibly porpoises, and meat from a small baleen whale (probably taken as carrion); pinnipeds are apparently killed by the sharks, though cetaceans may be more readily taken as carrion. Invertebrate prey, including octopi, squid, cuttlefish, spiny lobsters, crabs, horseshoe crabs, conchs and other marine gastropods, tunicates, and even jellyfish, is readily eaten, and tiger sharks have been found gorged with lobsters, horseshoe crabs and conchs. Carrion from terrestrial birds and mammals is commonly devoured, including that from dead chickens, rats, pigs, cattles, sheep, donkeys, dogs, hyenas, monkeys, and humans. Apart from people definitely known to be killed and eaten by tiger sharks, some of the other terrestrial vertebrates found in tiger shark stomachs may have been taken alive as well as in the form of carrion. These may become vulnerable to tiger sharks when they swim across estuaries or other bodies of water inhabited by these sharks, or when they fall or are tossed off of ships. The tiger shark is famed for swallowing an incredible variety of floating and bottom junk of human activity and natural sources, including leather, fabrics, pieces of coal and wood, seeds and other vegetable material, feathers, plastic bags, burlap bags, small barrels, cans, pieces of metal, etc.

The tiger shark is one of the most dangerous sharks, with more confirmed attacks on divers and swimmers (including multiple attacks) and attacks on boats being recorded for this species than all other sharks except the great white shark. Because most shark attacks occur in the tropics, where this species and other dangerous requiem sharks abound, this and other dangerous carcharhinids may actually be responsible for many more attacks than the far more notorious white shark. The tiger shark can be inquisitive and aggressive underwater, and may approach humans closely. In more than one instance tiger sharks have attacked divers while they were spearfishing or attracting sharks for photography, and had to be dissuaded by prompt aggressive action. An underwater encounter with this shark may not necessarily result in an attack, and may not result in an attack in most instances, but the species should be regarded with extreme caution because of its broad prey spectrum and lack of reluctance in eating unusual items. Certainly the tiger shark has the worst reputation as a man-eater amongst tropical sharks, and in part this may be deserved. In the West Indies and French Polynesia the tiger shark is considered the most dangerous of local sharks.

Size : Maximum reputed to be about 9.1 m, but this cannot be confirmed. Most tiger sharks are smaller than 5 m, with only a few large females reaching over 5.5 m. Males mature between 226 and 290 cm and reaching at least 370 cm; females maturing between 250 and 350 cm and reaching over 55 m, though most do not exceed 4.3 m; one gigantic adult female caught off Indo-China in 1957 was reported as being 740 cm long and weighing 3110 kg (Fourmanoir, 1961). Size at birth between 51 and 76 cm.

Interest to Fisheries : The tiger shark is commonly caught in coastal and offshore fisheries with longlines, hook-and-line, and fixed bottom nets as well as other gear. Its meat is utilized fresh, fresh frozen, dried salted and smoked for human consumption; its hide is of high quality and is used for leather and other products; its fins are used for shark fin soup base; and its liver, which often has a high vitamin potency, is processed for vitamin ed. This shark is fished by sports anglers and caught with rod and reel; it is one of the sharks recognized as a big-game fish by the International Game Fish Association and is currently the second largest all-tackle record fish taken by rod and reel after the great white shark.

Literature : Beebe & Tee-Van (1941), Fowler (1941); Bigelow & Schroeder (1948); Gudger (1949); Baughman & Springer (1950); Kauffman (1950); Cadenat (1957); Fourmanoir (1961); Garrick & Schultz (1963); Randall (1963); Gohar & Mazhar (1964); Springer (1960, 1963), Clark & von Schmidt (1965); Bass, D'Aubrey & Kistnasamy (1975a); Johnson (1978); Compagno & Vergara (1978); Compagno (1979, 1981); Cadenat & Blache (1981); Van der Elst (1981).

Glyphis Agassiz, 1843

CARCH Glyph

Genus : Glyphis Agassiz, 1843, Poiss.Foss., 3:243.

Type Species : Carcharias (Prionodon) glyphis Müller & Henle, 1839, by absolute tautonymy (see discussion below).

Synonymy : None.

Field Marks : Requiem sharks with short, broadly rounded snouts, small, wide-spaced nostrils, no spiracles, labial furrows confined to mouth corners, extremely small eyes, serrated triangular, broad-cusped upper teeth, no cusplets on lower teeth (except for first few anterolaterals in G. gangeticus), no keels on caudal peduncle, conspicuously protruding cusps on lower teeth, longitudinal precaudal pits, first dorsal midbase much closer to pectoral bases than pelvics, second dorsal fin half to 3/5 height of first, second dorsal origin slightly in front of anal origin, anal fin with preanal ridges virtually absent and with a deeply notched posterior margin.

Diagnostic Features : Body fairly stout. Head broad and flattened but not trowel-shaped; snout broadly parabolic or rounded in dorsoventral view and short, with the preoral length varying from about equal or somewhat less than internarial space but much less than mouth width; eyes extremely small, without posterior notches; spiracles absent; no papillose gillrakers on internal gill openings; nostrils small, internarial space 3 to 6 times the nostril width; anterior nasal flaps short, broadly to narrowly triangular, but not tubular; labial furrows short, essentially confined to mouth corners, with uppers shorter than lowers and falling far behind eyes; teeth strongly differentiated in upper and lower jaws; upper anteroposteriors with more or less erect, broad, triangular cusps, no cusplets or blades, and fine serrations; lowers with or without cusplets (on first few anterior teeth) or blades but with variably oblique to erect, long cusps and with serrations generally absent; cusps of lower teeth prominently protruding when mouth is closed; 29 to 37/28 to 34 rows of teeth. Interdorsal ridge absent; no lateral keels on caudal peduncle; upper precaudal pit longitudinal and not crescentic. First dorsal origin far anterior, over last thirds of pectoral bases, midbase much closer to pectoral bases than to pelvics and free rear tip well in front of pelvic fins; second dorsal fin much smaller than first but relatively large, its height 1/2 to 3/5 of first dorsal height or less, its origin slightly anterior to anal origin; pectoral fins moderately broad and falcate or semifalcate, their lengths from origin to free rear tip about 3/5 to nearly 3/4 of pectoral anterior margins; pectoral origins varying from about under interspace between third and fourth gill slits to under fourth gill slits; anal fin slightly smaller than second dorsal, with preanal ridges very short or absent and a deeply notched posterior margin. Colour grey or brownish above, without a colour pattern. Large sharks, to at least 2 m.

Remarks : The genus Glyphis is used here for the 'river sharks', two and possibly three or more species of poorly known, freshwater and estuarine sharks of the Indian Ocean and Western Pacific. This includes the famous, notorious, and elusive Ganges shark (G. gangeticus) of Indian waters.

The nomenclatural history of the genus Glyphis is somewhat checkered. Agassiz (1843) based his description of the genus primarily on a living species, Carcharias (Prionodon) glyphis Müller & Henle, 1839, which he mentioned in its text, but also named a new fossil species, G. hastalis. Elsewhere in the Poissons Fossils Agassiz (vol. 3, 1843, tab.mat.3e: 7) noted that Glyphis included "une espèce vivante et une fossil de l'Argile de Londres, le G. hastalis". Agassiz did not designate a type for Glyphis, but this must be C. (P.) glyphis by absolute tautonymy.

Fowler (1941) and Bigelow & Schroeder (1948) assumed that Glyphis as originally described by Agassiz included only a single species, G. hastalis, which they erroneously assumed was the type species by monotypy. Bigelow & Schroeder (1948) cited 1838 as the earliest date for Glyphis, on a plate caption for G. hastalis (Agassiz, Poissons Fossils, Atlas, vol. 3, pl. 36). However, according to Woodward & Sherborn (1890) the plate in question was apparently published in 1845 and hence postdates the text description of Glyphis.

Fowler (1928, 1941) erroneously used Glyphis to replace Prionace Cantor, 1849, as a generic name for the blue shark, P. glauca (Linnaeus, 1758). Apart from the subsequent stabilization of Prionace as the generic name of the blue shark by the International Commission on Zoological Nomenclature (Opinion 723, 1965) and confusion on the type species of Glyphis, this action is unwarranted because neither the living type species of Glyphis or the fossil G. hastalis are congeneric with the blue shark.

Garrick (1982) excluded *Carcharias* (*Prionodon*) *glyphis* and *C.* (*P.*) *gangeticus* Müller & Henle, 1839 from the genus *Carcharhinus*, but did not place them in a given genus. He noted that these two species "....share many similarities with each other and differ less from *Carcharhinus* than does *temmincki*". Extending Garrick's conclusions requires that the genus *Glyphis* be expanded to include *C.* (*P.*) *gangeticus* as well as *C.* (*P.*) *glyphis* and *G. hastalis*. The genus *Lamiopsis*, as recognized here and in Compagno (1979) for *C.* (*P.*) *temmincki* Müller & Henle, 1839, is close to *Glyphis* but readily distinguishable from it and from *Carcharhinus*.

Garrick (pers. comm.) notes that there may be at least one additional living species in this genus, similar to *G. glyphis* but separable by vertebral counts and possibly other characters.

Key to Species :

1a. First few anterior teeth in lower jaw with entire smooth cutting edges and low cusplets on the crown foot. Second dorsal fin lower, about half height of first dorsal .... ***G. gangeticus***

1b. First few anterior teeth in lower jaw with cutting edges confined to tips of cusps, giving cusps a spearlike shape, and no cusplets. Second dorsal higher, about 3/5 height of first dorsal .... ***G. glyphis***

Glyphis gangeticus (Müller & Henle, 1839)

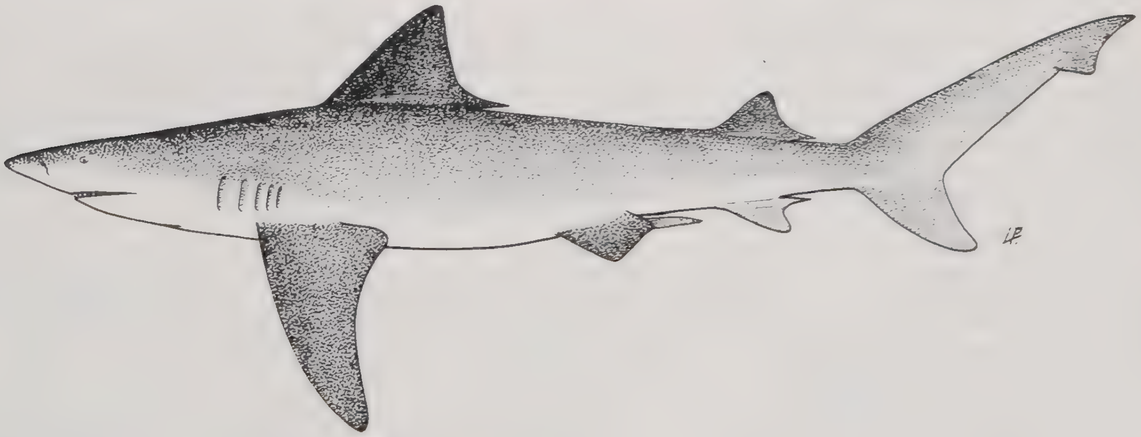
CARCH Glyph 1

Carcharias (*Prionodon*) *gangeticus* Müller & Henle, 1839, *Syst.Beschr.Plagiost.*, (2):39, pl. 13. Syntypes : A stuffed adult or late adolescent male about 1780 mm long in the Zoologisches Museum, Humboldt Universitat, Berlin apparently lost, and an alcohol-preserved specimen in the Museum National d'Histoire Naturelle, MNHN 1144, 564 mm long. Type Locality: "Im Ganges, 60 Stunden oberhalb des Meers bei Houghly gefangen".

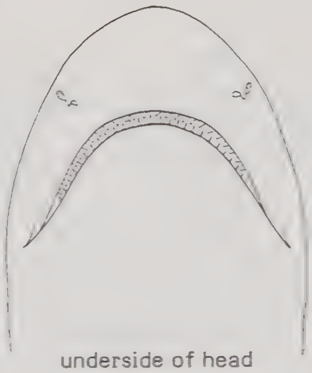
Synonymy : ? *Carcharias murrayi* Günther, 1887.

Other Scientific Names Recently in Use : *Carcharhinus gangeticus* (Müller & Henle, 1839); *Eulamia gangetica* (Müller & Henle, 1839); *Platypodon gangeticus* (Müller & Henle, 1839).

FAO Names : En - Ganges shark; Fr - Requin du Ganges; Sp - Tiburón del Ganges.



Field Marks : A fairly stocky requiem shark with a broadly rounded short snout, preoral snout much shorter than mouth width but with a rather long preorbital snout, minute eyes, first dorsal origin over rear ends of pectoral bases, second dorsal rather large, about 1/2 height of first dorsal, upper teeth with high, broad, serrated triangular cusps, lower anterior teeth with long, hooked, protruding cusps having unserrated cutting edges not confined to spearlike tips and crown feet with low cusplets, no interdorsal ridge, upper precaudal pit longitudinal, no conspicuous markings.



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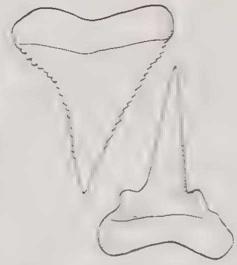
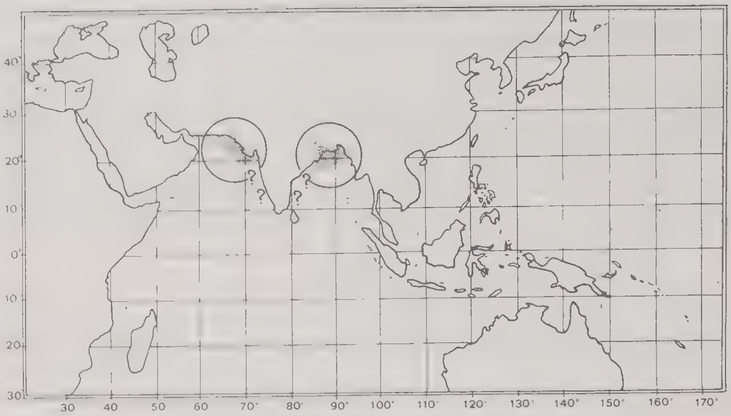


upper and lower tooth

Diagnostic Features : First few anterior teeth in lower jaw with cutting edges along entire cusp, giving the cusps a clawlike shape, and low cusplets; second dorsal lower, about half the height of first dorsal.



Geographical Distribution : Indo-West Pacific: Definitely known from the Hooghly River, Ganges system, West Bengal, India, and likely from the vicinity of Karachi, Pakistan (see remarks below).

Habitat and Biology : A poorly known freshwater riverine and possibly inshore marine and estuarine shark. Probably viviparous. The Ganges shark has a horrific reputation as a maneater in the Ganges-Hooghly system, but this is unproven (see remarks below).

Size : Maximum possibly to at least 204 cm (type of *Carcharias murrayi*); adult or adolescent male 178 cm (stuffed syntype); newborn specimens 56 to 61 cm.

Interest to Fisheries : Probably fished in the Ganges-Hooghly system, but details unknown.

Literature : Fowler (1941); Garrick & Schultz (1963); Boeseman (1964); Garrick (1967, 1982, pers. comm.); Budker & Whitehead (1972); Bass, D'Aubrey & Kistnasamy (1973).

Remarks : The elusive Ganges shark has been famed and fabled for its occurrence in fresh water as well as for its bloody reputation as a maneater there. Originally known only from the type locality, it was gradually recorded from the entire span of the Indo-West Pacific until Fowler (1941), in a masterpiece of compilation bearing little relationship to reality, recorded the species from Arabia and India to Borneo, Viet Nam, China, Japan, Australia, the Philippines, and Fiji and the Hawaiian Islands. However, with the critical survey of carcharhinids begun in the early 1960s, most of the marine and freshwater records of the Ganges shark could not be substantiated and many were found to be based on *Carcharhinus leucas*, *C. amboinensis* and other species (see Garrick & Schultz, 1963; Boeseman, 1964; Garrick, 1967, 1982; Bass, D'Aubrey & Kistnasamy (1973). Boeseman (1964) noted that "most of the recorded *C. gangeticus* from outside the Indo-Pakistan Peninsula (excepting those from Japan and possibly, from Viti-Levu, Fiji Islands), are identical with *C. leucas* Müller & Henle.", and since then confirmation of records of the species from Japan and Fiji has not been forthcoming. Lineaweaver & Backus (1970) and Ellis (1975, 1983) even considered the Ganges shark a synonym of *Carcharhinus leucas*, although Garrick (1982) recognized it as distinct.

During a trip to India in 1982 the writer discovered an additional specimen of *G. gangeticus* in the fish collection of the Zoological Survey of India in Calcutta (ZSI 8067, 61 cm newborn female, misidentified as *Carcharhinus temmincki*), collected by Dr J. Anderson from the Hooghly River on 4 April 1867. This confirmed Garrick's recognition of the species, but sheds little additional light on its biology. It is apparently only the fourth verified specimen of this rare shark, including the two syntypes (one lost) and possibly the holotype of *Carcharias murrayi* (also lost), and hence is one of two extant specimens in museum collections. Garrick (1982) suggested that *Carcharias murrayi* is a possible synonym of this species, with which the writer concurs.

The writer examined another specimen in the Zoological Survey collections labelled *Squalus gangeticus* (ZSI 10250, 65 cm newborn male) but bearing the same data (Hooghly River, collected by Dr J. Anderson, 4 April 1867) as the true *gangeticus* specimen; but this turned out to be the circumtropical bull shark, *Carcharhinus leucas*. Although Garrick (1982) had not examined specimens of *leucas* from the Indian subcontinent, the writer found *leucas* material from Cochin and Bombay as well as the Hooghly specimen.

Thus there are two species of sharks in the Hooghly River, and, with the well-known affinities of *C. leucas* for fresh water, probably two Ganges River sharks as well. The hideous reputation of the true Ganges shark grew on the assumption that there was only one species of shark in fresh water in the Hooghly-Ganges system, which was responsible for the numerous attacks on people reported by Day (1878) and other writers. However, the Ganges shark may eventually have to pass on much or all of its notoriety to the more prosaic but perhaps more dangerous and formidable bull shark. In comparison with *Carcharhinus leucas*, *Glyphis gangeticus* has much narrower, higher, upper teeth and slender-cusped, less heavily built lower teeth. The teeth of the Ganges shark appear more suitable for fish-impaling and less useful for dismembering tough mammalian prey than the very stout teeth of the bull shark. The presence of the bull shark (one of the most dangerous living species) in the Hooghly and perhaps the Ganges along with readily available human prey and mammalian carrion suggests that with widespread confusion of this shark and *C. leucas* in India and elsewhere its bad reputation must be considered uncertain at best. The Ganges shark is potentially dangerous because of its size and large teeth, but at present its relation to humans is a mystery, along with almost all other aspects of its biology. Although sharks are currently caught in the Ganges system (P.K. Talwar, pers. comm.), it is not known how common the true Ganges shark is relative to the bull shark. It is also quite uncertain how well the Ganges shark is adapted to fresh water, or for that matter, how well it can live in sea water. The presence of newborn individuals in the Hooghly River suggests that at least the young may be born in fresh water. The minute eyes of the Ganges shark, along with other *Glyphis* sharks, suggests that the entire group may be adapted to turbid water with poor visibility, as in large tropical rivers and muddy estuaries.

Glyphis glyphis (Müller & Henle, 1839)

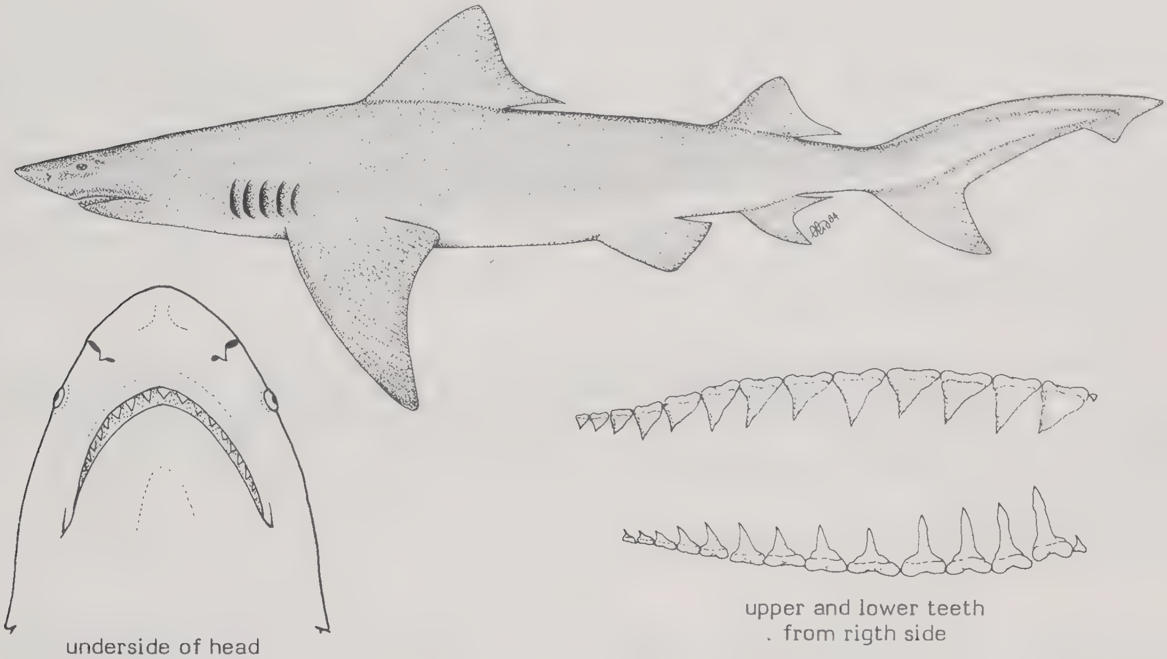
CARCH Glyph 2

Carcharias (Prionodon) glyphis Müller & Henle, 1839, Syst.Beschr.Plagiost., (2):40, pl. 14. Holotype: About 1 m long, stuffed specimen in Zoologisches Museum, Humboldt Universitat, Berlin. Type Locality: Unknown.

Synonymy : None.

Other Scientific Names Recently in Use : Carcharhinus glyphis (Müller & Henle, 1839).

FAO Names : En - Speartooth shark; Fr - Requin lancette; Sp - Tiburón lanza.



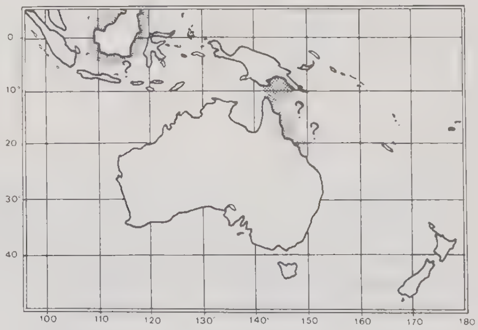
underside of head

upper and lower teeth from rigth side

Field Marks : A stocky requiem shark with a broadly rounded short snout, preoral snout much shorter than mouth width but preorbital snout rather long, minute eyes, first dorsal origin over rear ends of pectoral bases, second dorsal rather large, about 3/5 height of first dorsal, upper teeth with high, broad, serrated triangular cusps, lower anterior teeth with long, hooked, protruding cusps with unserrated cutting edges confined to slightly expanded spearlike tips, no interdorsal ridge, upper precaudal pit longitudinal, no conspicuous markings.

Diagnostic Features : First few anterior teeth in lower jaw with cutting edges confined to tips of cusps, giving the cusps a spearlike shape, and no cusplets. Second dorsal higher, about 3/5 height of first dorsal.

Geographical Distribution : Uncertain. G. glyphis-like sharks occur in Borneo, New Guinea, and Queensland, Australia, but it is uncertain at present if any of these are the true G. glyphis (see remarks below).



Habitat and Biology : Presumably inshore and possibly in fresh water. Biology unknown.

Size : Maximum at least 1 m; this or a related species in New Guinea may reach 2 to 3 m.

Interest to Fisheries : Unknown.

Literature : Garrick (1982, and pers. comm.).

Remarks : This mysterious, apparently rare shark was long known only from Müller & Henle's (1839) original account. Prof. J.A.F. Garrick (pers. comm.) has obtained additional specimens of glyphis-like snarks from New Guinea, Borneo and Queensland, Australia. However, these may represent more than one species, as the Borneo and New Guinean specimens differ significantly in vertebral counts, and it is uncertain at present which of these (if any) represent the true G. glyphis. This problem is under study by Prof Garrick and the writer.

Isogomphodon Gill, 1862

CARCH Iso

Genus : Isogomphodon Gill, 1862, Ann.Lyceum Nat.Hist.N.Y., 7:401.

Type Species : Carcharias (Prionodon) oxyrhynchus Müller & Henle, 1839, by original designation.

Synonymy : None.

Diagnostic Features : Body fairly stout. Head narrow and flattened but not trowel-shaped; snout acutely triangular or subtriangular in dorsoventral view and very long, with preoral length much greater than internarial space and mouth width; eyes extremely small, without posterior notches; spiracles absent; no papillose gillrakers on internal gill openings; nostrils small, internarial space about 3 times the nostril width; anterior nasal flaps vestigial, not tubular; labial furrows short but prominent, essentially confined to mouth corners, with uppers about equal to lowers and with their anterior ends falling far behind eyes; teeth not strongly differentiated in upper and lower jaws, anteroposteriors with more or less erect, narrow acute cusps, no cusplets, and proximal and distal blades; uppers with slightly broader flatter cusps and serrations; lowers with slenderer cusps and smooth edges; cusps of lower teeth not protruding when mouth is closed; 49 to 60/49 to 56 rows of teeth. Interdorsal ridge absent; no lateral keels on caudal peduncle; upper precaudal pit transverse and crescentic. First dorsal origin far forward, over midbase or second third of pectoral bases, its midbase much closer to pectoral bases than to pelvics and free rear tip well anterior to pelvic fin origins; second dorsal fin considerably smaller than first but rather large, its height about 1/2 of first dorsal height, its origin slightly anterior or opposite anal origin; pectoral fins broad and triangular, their lengths from origin to free rear tip about 3/4 of pectoral anterior margins; pectoral origins about under 5th gill slit; anal fin somewhat smaller than second dorsal, with preanal ridges very short and a deeply notched posterior margin. Colour grey or brownish above, without a colour pattern. Moderate-sized sharks, adults probably not exceeding 1.6 m.

Remarks : The genus Isogomphodon was until recently synonymized with Carcharhinus (see Bigelow & Schroeder, 1948; Garrick & Schultz, 1963; Garrick, 1967). However, Springer (1950) resurrected it and Compagno (1970, 1979) and Compagno & Vergara (1978) resurrected it a second time, and Compagno (1979) gave a taxonomic history of the genus and a detailed review of its relationships. Garrick (1982) excluded the single species included in Isogomphodon, Carcharias (Prionodon) oxyrhynchus Müller & Henle, 1839, from Carcharninus.

Isogomphodon oxyrhynchus (Müller & Henle, 1839)

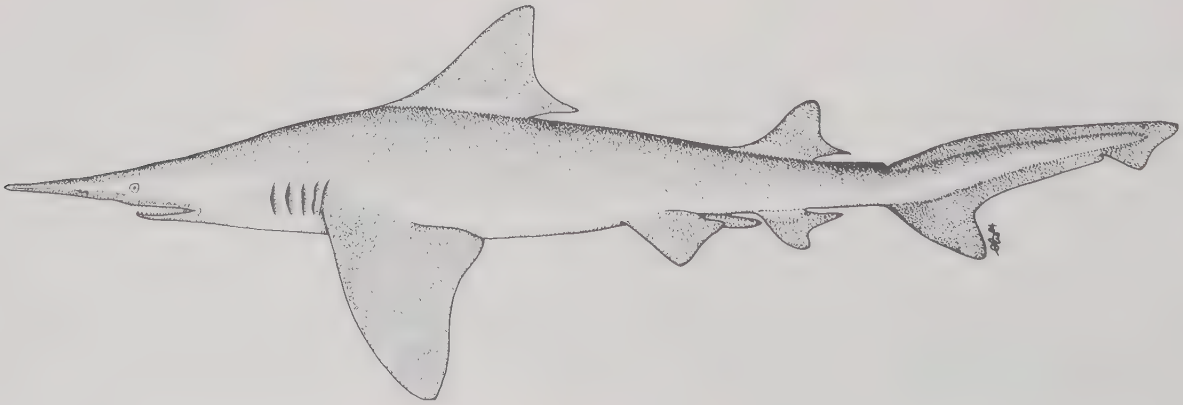
CARCH Iso 1

Carcharias (Prionodon) oxyrhynchus Müller & Henle, 1839, Syst.Beschr.Plagiost. (2):41, pl. 15. Syntypes: Rijksmuseum van Natuurlijke Historie, Leiden. Type Locality: Surinam.

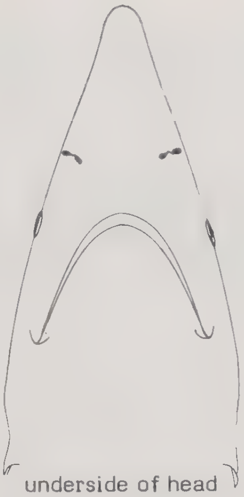
Synonymy : None.

Other Scientific Names Recently in Use : Carcharhinus oxyrhynchus (Müller & Henle, 1839)

FAO Names : En - Daggernose shark; Fr - Requin bécune; Sp - Cazón picudo.



Field Marks : An unmistakable requiem shark, with an extremely long, flattened, acutely pointed, triangular snout, minute circular eyes with nictitating eyelids, very large, paddle-shaped pectoral fins, the first dorsal fin with its origin over the pectoral fins, narrow, erect-cusped small teeth, without cusplets, in both jaws, upper teeth serrated, and over 45 rows of teeth in both jaws, and colour grey or yellow-grey above and white below, without prominent markings. This shark bears a superficial resemblance to rhinochimaerids, the goblin shark (Mitsukurina) and certain undescribed species of the scyliorhinid genus Apristurus, all of which have similar long snouts.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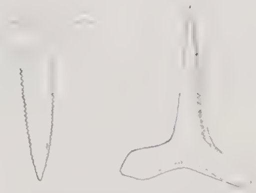

upper and lower tooth

Diagnostic Features : See genus.

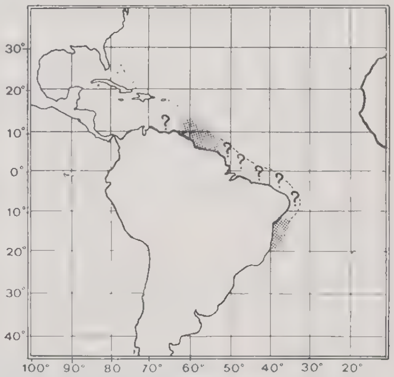
Geographical Distribution : Western Atlantic: Trinidad, Guayana, Surinam, French Guinea, probably central Brazil (Valenca, Bahia).

Habitat and Biology : A bizarre, little-known, inshore tropical shark of continental waters of Atlantic South America. Described as commonly frequenting estuaries and river mouths, and occurring over rocky bottoms.

This is a viviparous species, with a yolk-sac placenta; number of young recorded as 4 per litter.

The daggernose shark feeds on small schooling fishes including herring, anchovies and croakers, for which its long jaws and small, spikelike teeth are very well suited. Its small eyes and very long snout may be adaptations for feeding in turbid water, emphasizing rostral sense organs over sight.

This shark is not known to be dangerous to people, and its small teeth and small size suggest that it is an innocuous fish-eater.



Size : Maximum said to be about 200 to 244 cm, but not verified above 152 cm, males adolescent at about 96 cm and adult at 108 cm; size at birth about 38 to 41 cm.

Interest to Fisheries : Limited, apparently taken in small numbers by local fishermen in Trinidad, the Guayanas, and apparently central Brazil, where it is an incidental bycatch of other fisheries. Caught in fixed bottom gillnets and longlines. Occasionally marketed, but not considered a prime food fish.

Literature : Bigelow & Schroeder (1948); Compagno (1970, 1979); Cervigon (1971); Compagno & Vergara (1978); Cadenat & Blache (1981); S. Springer (pers. comm.); J.C. Cordell (pers. comm.).

Lamiopsis Gill, 1862

CARCH Lamio

Genus : Lamiopsis Gill, 1862, Ann.Lyceum Nat.Hist.New York, 7:401.

Type Species : Carcharias (Prionodon) temmincki, Müller & Henle, 1839, by original designation.

Synonymy : None.

Diagnostic Features : Body fairly stout. Head broad and flattened but not trowel-shaped; snout broadly parabolic in dorsoventral view and moderately long, with preoral length considerably greater than internarial space and nearly equal to mouth width; eyes fairly small, without posterior notches; spiracles absent; no papillose gillrakers on internal gill openings; nostrils small, internarial space about 3 times the nostril width; anterior nasal flaps short, broadly triangular, but not tubular; labial furrows short, essentially confined to mouth corners, with uppers shorter than lowers and falling far behind eyes; teeth strongly differentiated in upper and lower jaws; upper anteroposteriors with more or less erect, broad, triangular cusps, no cusplets or blades, and serrations; lowers without cusplets but with variably oblique to erect, long hooked cusps and with serrations absent; cusps of lower teeth slightly protruding when mouth is closed; 29 to 37/28 to 34 rows of teeth. Interdorsal ridge absent; no lateral keels on caudal peduncle; upper precaudal pit longitudinal and not crescentic. First dorsal origin over pectoral inner margins, its midbase slightly closer to pectoral bases than to pelvics and free rear tip slightly anterior, over, or slightly posterior to pelvic fin origins; second dorsal fin nearly as large as first, its height 3/4 or more of first dorsal height; its origin about opposite anal origin; pectoral fins broad and triangular, their lengths from origin to free rear tip over 3/4 of pectoral anterior margins; pectoral origins varying from under fourth gill slit to under interspace between fourth and fifth gill slits; anal fin somewhat smaller than second dorsal, with preanal ridges very short or absent and a nearly straight to slightly concave posterior margin. Colour grey or brownish above, without a colour pattern. Moderate-sized sharks, adults probably not exceeding 2 m.

Remarks : This genus is usually synonymized with *Carcharhinus* but was revived for *Carcharias* (*Prionodon*) *temmincki* Müller & Henle, 1839 by Compagno (1970, 1979). See the latter account for the rationalle for recognizing this genus. Garrick (1982) has excluded *temmincki* from *Carcharhinus* in his revision of the genus, and Cadenat & Blache (1981) has recognized *Lamiopsis* also.

Lamiopsis temmincki (Müller & Henle, 1839)

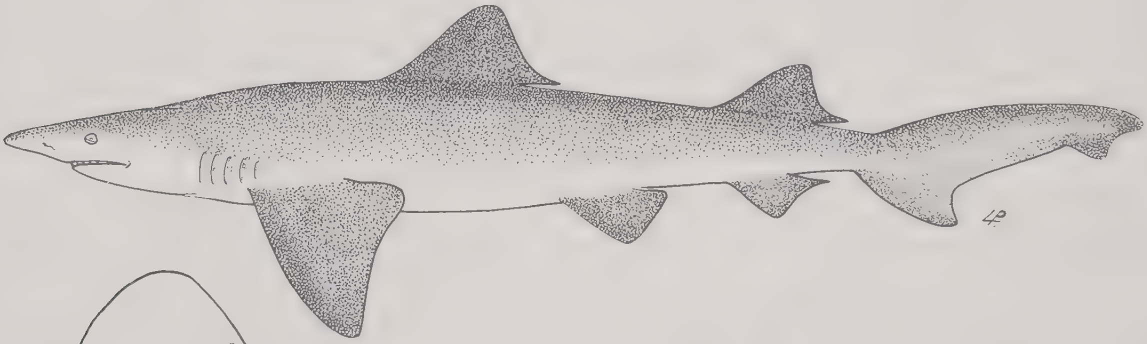
CARCH Lamio 1

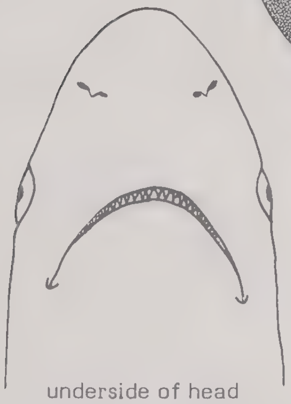
Carcharias (*Prionodon*) *temmincki* Müller & Henle, 1839, *Syst.Beschr.Plagiost.*, (2):48, pl. 18. Syntypes: Berlin Zoological Museum, Zoological Society of London collection, Rijksmuseum van Natuurlijke Historie, Leiden and Museum National d'Histoire Naturelle, Paris. Type Locality: "Indien", Paris specimen from Pondicherry.

Synonymy : *Carcharias tephrodes* Fowler, 1905; *Carcharhinus microphthalmus* Chu, 1960.

Other Scientific Names Recently in Use : *Carcharhinus temmincki* (Müller & Henle, 1839); *Eulamia temmincki* (Müller & Henle, 1839).

FAO Names : En - Broadfin shark; Fr - Requin grandes ailes; Sp - Tiburón aletón.





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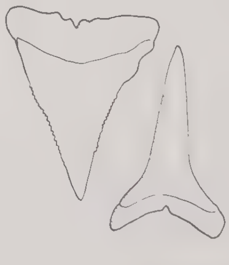
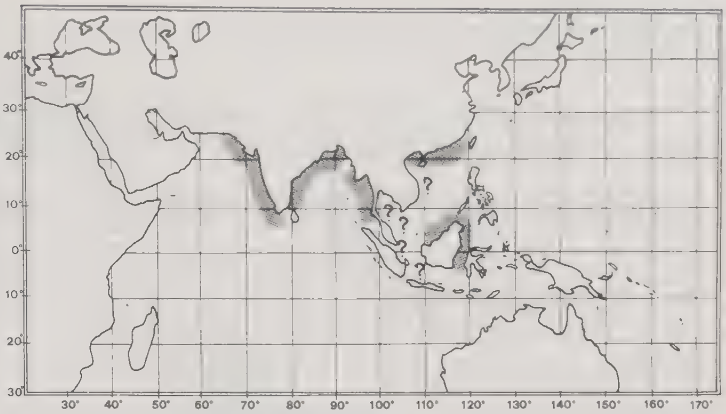


upper and lower tooth

Field Marks : A small, rather stocky requiem shark with a moderately long snout nearly equal to mouth width, a small round eye with a nictitating eyelid, second dorsal fin nearly as large as first, upper teeth serrated and with broad triangular cusps, lower teeth with smooth, hooked, narrow cusps, longitudinal upper precaudal pit, pectoral fins broad and triangular, anal fin with posterior margin nearly straight, and colour light grey or tan above, light below, with no prominent markings.

Diagnostic Features : See genus.



Geographical Distribution : This species has a scattered distribution in the Indian Ocean and Western Pacific off Pakistan, India, Burma, Indonesia (Makassar Straits), Sarawak and China. It is not known at present if its distribution is acutally discontinuous, or if it occurs in many other localities connecting the sporadic records as presently known.

Habitat and Biology : A little-known, continental, inshore shark, apparently only common on the west coast of India (in the Bombay region), but rare elsewhere. Viviparous, number of young 4 to 8 per little (8 commonest). In Bombay waters, most are born before the monsoon season, in April and May. Sketchy data on its breeding suggests a gestation period of about 8 months, but this needs to be confirmed. Feeding habits not reported, probably small fishes and invertebrates. Not known to be dangerous to people.

Size : Maximum 168 cm; smallest adult males 114 cm, females pregnant at 130 to 162 cm; size at birth between 40 and 60 cm.

Interest to Fisheries : Apparently regularly taken by local fishermen of India (Bombay) and Pakistan (Karachi), but probably caught elsewhere. Taken in bottom and floating gillnets and with line gear. Meat utilized fresh for human consumption; livers used for vitamin oil.

Literature : Fowler (1941); Setna & Sarangdhar (1949, 1949b); Chu et al. (1962); Misra (1969); Compagno (1979); P.C. Heemstra (pers. comm.); J.A.F. Garrick (pers. comm.).

Remarks : Data on the holotype of Carcharias tephrodes indicates that it is a synonym of this species (Compagno, 1979). The account of Carcharhinus microphthalmus in Chu et al. (1962), suggests nothing to separate it from this species, and hence it is tentatively ranked as a synonym of Lamiopsis temmincki.

Loxodon Müller & Henle, 1838

CARCH Lox

Genus : Loxodon Müller & Henle, 1838, Mag.Nat.Hist., (2):36 (no species).

Type Species : Loxodon macrorhinus Müller & Henle, 1839, by subsequent monotypy.

Synonymy : None.

Diagnostic Features : Body rather slender. Head fairly narrow, only moderately depressed, not trowel-shaped; snout narrowly parabolic in dorsoventral view, very long, with preoral length greater than internarial space and mouth width; eyes large, with posterior notches; spiracles absent or minute and vestigial; no papillose gillrakers on internal gill openings; nostrils small, internarial space about 4 to 5 times nostril width; anterior nasal flaps very short, narrowly triangular, and not tubular; labial furrows very short to rudimentary, with uppers shorter than lowers and falling far behind eyes; teeth similar in upper and lower jaws, anteroposteriors with slender oblique cusps and distal blades but no cusplets or serrations; cusps of lower teeth not prominently protruding when mouth is closed; 25 to 28/24 to 28 rows of teeth. Interdorsal ridge absent or rudimentary; no dermal keels present on caudal peduncle; upper precaudal pit transverse and crescentic. First dorsal origin behind pectoral rear tips, midbase about equidistant between pectoral and pelvic bases, and free rear tip usually anterior to pelvic origins but occasionally over them; second dorsal fin much smaller than first, its height 1/4 of first dorsal height or less; its origin about over anal insertion; pectoral fin moderately broad and triangular, slightly falcate, pectoral length from origin to free rear tip 2/3 to 3/4 of pectoral anterior margin; pectoral origins under interspace between third and fourth gill slits; anal much larger than second dorsal, with very long preanal ridges and a straight or slightly concave posterior margin. Colour light grey, yellowish or brownish grey above, without a colour pattern. Small sharks, adults not exceeding 1 m.

Remarks : Scope and synonymy of this genus follows Springer (1964).

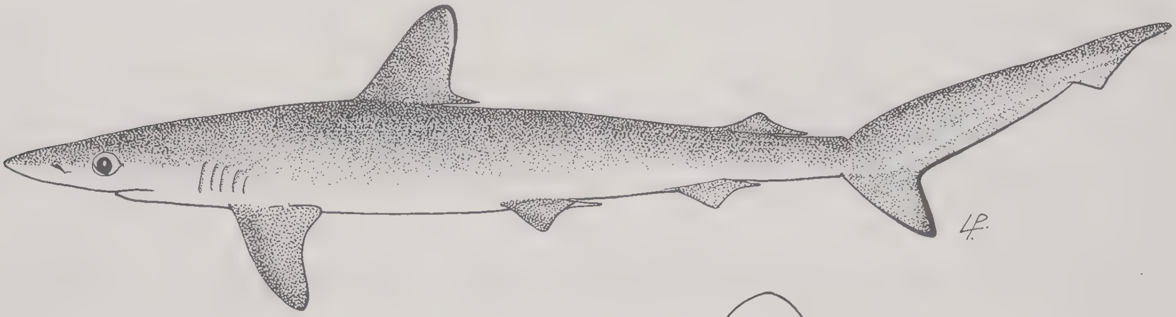
Loxodon macrorhinus Müller & Henle, 1839

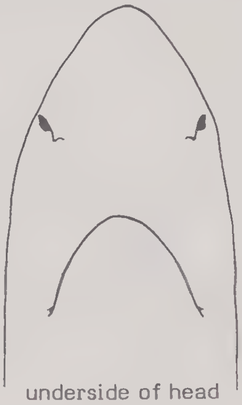
CARCH Lox 1

Loxodon macrorhinus Müller & Henle, 1839, Syst.Beschr.Plagiost., (2):61, pl. 25. Holotype: Zoologisches Museum, Humboldt Universitat, Berlin, ISZZ 4479, 315 mm fetus. Type Locality: Unknown.

Synonymy : Carcharias (Scoliodon) dumerili Bleeker, 1865; Carcharias albomarginatus Hemprich & Ehrenberg, 1899; Scoliodon jordani Ogilby, 1908; Scoliodon affinis Ogilby, 1912; Scoliodon ceylonensis Setna & Sarangdhar, 1946.

FAO Names : En - Sliteye shark; Fr - Requin sagrin; Sp - Tiburón ojuelo.





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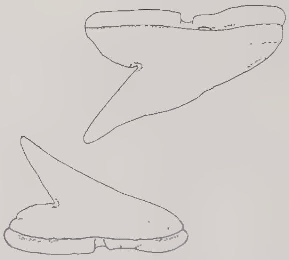


upper and lower tooth

Field Marks : A small, very slim requiem shark with a long snout, big eyes with posterior notches, labial furrows very short or rudimentary, small, oblique-cusped teeth without serrations or cusplets, first dorsal origin behind pectoral free rear tips, second dorsal much smaller than first, second dorsal origin about over anal insertion, anal larger than second dorsal, with very long preanal ridges. Colour greyish to brownish without a prominent colour pattern.

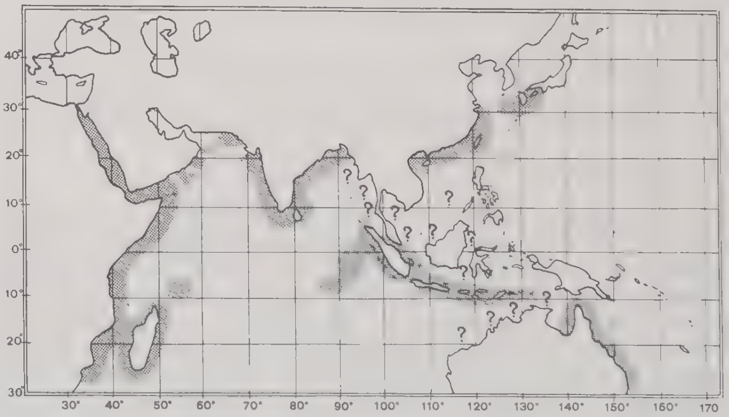
Diagnostic Features : See genus.

Geographical Distribution : Confined to the Indo-West Pacific: South Africa, Madagascar, Seychelles and Red Sea east to India, Sri Lanka, Indonesia, China, Taiwan Island, Japan, The Philippines, Australia (Queensland and probably other states).

Habitat and Biology : A small, common tropical inshore shark of the continental and insular shelves, found in moderately shallow, clear waters, at depths from 7 to 80 m; occurs near the surface and at the bottom.

Viviparous, with a yolk-sac placenta; number of young 2 to 4 per litter.

Feeds on small bony fishes, including anchovies and croakers, and shrimp and cuttlefish. Harmless to people.



Size : Maximum 91 cm, males maturing between 62 and 66 cm and reaching at least 85 cm; females mature at 79 cm and reaching at least 91 cm; size at birth about 40 to 43 cm.

Interest to Fisheries : This small shark is caught in artisanal and smallscale commercial fisheries, and is especially important in southeastern India. It is taken in floating and bottom gillnets and with pelagic and bottom longlines; its meat is utilized fresh for human consumption.

Literature : Fowler (1941); Setna & Sarangdhar (1949b,c), Wheeler (1959); V. Springer (1964); Nair, Appukuttan & Rajapandian (1974); Bass, D'Aubrey & Kistnasamy (1975b); Compagno (1979).

Nasolamia Compagno & Garrick, 1983

CARCH Nas

Genus : Nasolamia Compagno & Garrick, 1983, Occas.Pap.Victoria U., Wellington, (76):3.

Type Species : Carcharhinus velox Gilbert, in Jordan & Evermann, 1898, by original designation.

Synonymy : None.

Diagnostic Features : Body rather slender. Head very narrow, conical and only slightly depressed, not trowel-shaped; snout narrowly pointed in dorsoventral view, very long, with preoral length greater than internarial space and mouth width; eyes fairly large, without notches; spiracles absent; no papillose gillrakers on internal gill openings; nostrils very large, close-spaced and nearly transverse, internarial space about 1.1 to 1.3 times the nostril width; anterior nasal flaps vestigial, not tubular; labial furrows very short, uppers shorter than lowers and falling far behind eyes; teeth differentiated in upper and lower jaws; upper anteroposteriors with fairly broad semierect to oblique cusps, distal blades and serrations but no cusplets; lowers with slender, narrow, semierect cusps, blades and serrations but no cusplets; lower teeth not prominently protruding when mouth is closed; 27 to 30/24 to 28 (usually 28/25 to 27) rows of teeth. Interdorsal ridge absent; no dermal keels present on caudal peduncle; upper precaudal pit transverse and crescentic. First dorsal origin over pectoral inner margins, its midbase somewhat closer to pectoral bases than pelvic, and its free rear tip slightly anterior to pelvic origins; second dorsal fin much smaller than first, its height less than 1/3 of first dorsal height; its origin over or slightly anterior to anal insertion; pectoral fins moderately broad and triangular, slightly falcate, pectoral length from origin to free rear tip about 3/4 of pectoral anterior margin; pectoral origins under third gill slit or interspace between third and fourth gill slits; anal slightly larger than second dorsal, with short preanal ridges and a deeply notched posterior margin. Colour light grey or brownish grey above, without a colour pattern. Moderately large sharks, adults not exceeding 1.6 m.

Remarks : This 'satellite genus' of Carcharhinus differs from it and all other carcharhinids in its enlarged, close-set nostrils, narrow conical snout and various cranial characters (see Compagno & Garrick, 1983). Its only species, Nasolamia velox, is close to Carcharhinus acronotus in dentition and other features and may be a sister species to it by common ancestry. However, acronotus lacks the derived peculiarities of velox and is retained in Carcharhinus.

The aggregation of odd rostral and cranial characters of N. velox is reminiscent of incipient stages of the teratogenic continuum of cyclopia in vertebrates. It is tempting to speculate that Nasolamia is derived from an acronotus-like ancestry in Carcharhinus by stabilization of a complex of incipient, cyclopic abnormalities that gave N. velox a selective advantage over normal acronotus-like Carcharhinus.

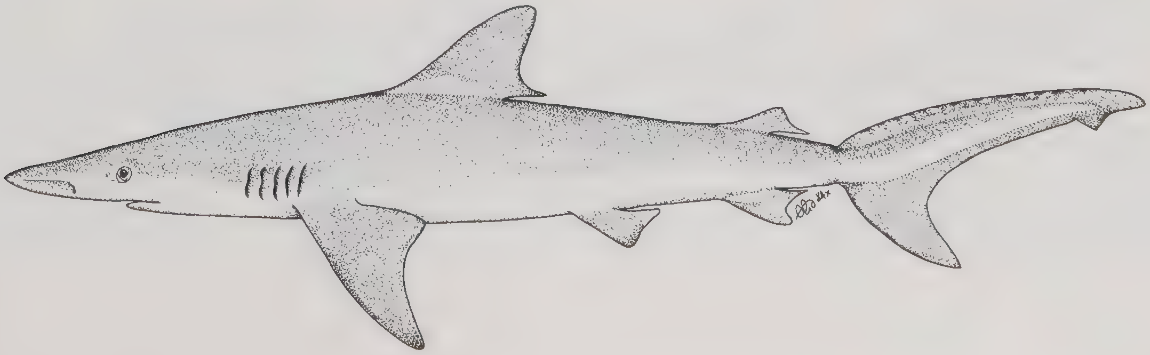
Nasolamia velox (Gilbert, 1898)

CARCH Nas 1

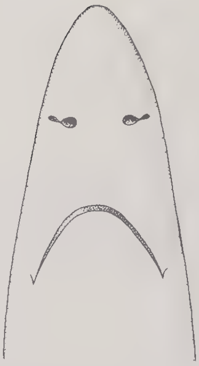
Carcharhinus velox Gilbert, in Jordan & Evermann, 1898, Bull.U.S.Nat.Mus., (47)3:2747. Holotype: Stanford University Natural History Museum, SU 11893, 1200 mm immature female. Type Locality: Pacific Panama.

Synonymy : None.

FAO Names : En - Whitenose shark; Fr - Requin nez blanc; Sp - Cazón trompa blanca.



Field Marks : A slender requiem shark, with a very long, conical snout and very large, close-set nostrils, these separated by a space only slightly greater than the nostril width, a black spot outlined with white on the dorsal snout tip; form otherwise like that of the grey sharks, Carcharhinus species (especially C. acronotus, see remarks above).



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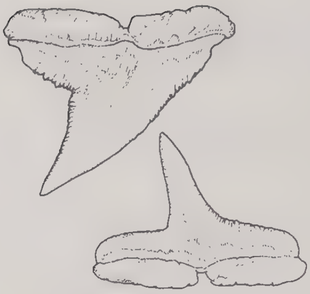


upper and lower tooth

Diagnostic Features : See genus.

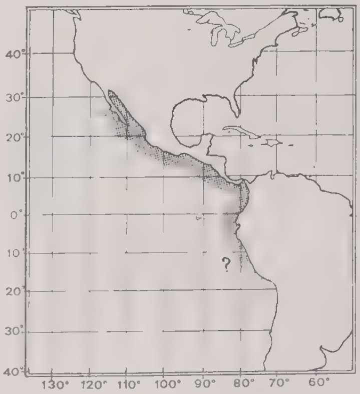
Geographical Distribution : Eastern Pacific: Baja California and Gulf of California, Mexico to Peru.

Habitat and Biology : A little-known but relatively common inshore and offshore tropical shark of the continental shelves, usually found at depths of 15 to 24 m or less, but occasionally down to 192 m depth. Viviparous, with a yolk-sac placenta; 5 young in a litter. Feeds on small bony fishes, including anchovies and crabs. Not known to have attacked people.

Size : Maximum at least 150 cm; males immature at 92 to 106 cm but adult at 140 cm; size at birth about 53 cm.

Interest to Fisheries : Locally common and caught with longlines and no doubt other gear; utilized fresh or fresh frozen for human consumption and for fishmeal.

Literature : Beebe & Tee-Van (1941); Rosenblatt & Baldwin (1958); Kato, Springer & Wagner (1967); Chirichigno (1978); Compagno & Garrick (1983).



Negaprion Whitley, 1940

CARCH Neg

Genus : Negaprion Whitley, 1940, Fish.Australia, (1):111.

Type Species : Aprionodon acutidens queenslandicus Whitley, 1939, by original designation, a junior synonym of Negaprion acutidens (Rüppell, 1837).

Synonymy : Genus Mystidens, Whitley, 1944; Genus Hemigaleops Schultz, in Schultz et al., 1953.

Field Marks : Requiem sharks with second dorsal fin about as large as first, very short, broadly rounded or angular snouts, usually no spiracles, labial furrows confined to mouth corners, narrow-cusped, largely smooth-edged upper teeth (serrations when present confined to upper tooth blades), no cusplets on any teeth, no keels on caudal peduncle, longitudinal precaudal pits, first dorsal midbase closer to pelvic bases than pectorals, anal fin with preanal ridges virtually absent and with a deeply notched posterior margin.

Diagnostic Features : Body stout. Head very broad and flattened but not trowel-shaped; snout broadly rounded or almost wedge-shaped in dorsoventral view and short, with preoral length subequal to internarial space and much less than mouth width; eyes small, without posterior notches; spiracles absent; no papillose gillrakers on internal gill openings; nostrils small, internarial space about 3 to 5 times the nostril width; anterior nasal flaps short, broadly triangular, but not tubular; labial furrows very short, essentially confined to mouth corners, with uppers shorter than lowers and with their ends falling far behind eyes; teeth strongly differentiated in upper and lower jaws; upper anteroposteriors with more or less erect, slender, narrow cusps, no cusplets, and serrations either absent or confined to crown feet; lowers without cusplets but with mostly erect, fairly long slightly hooked cusps and no serrations; cusps of lower teeth not protruding when mouth is closed; 27 to 33/27 to 33 rows of teeth. Interdorsal ridge absent; no lateral keels on caudal peduncle; upper precaudal pit longitudinal and not crescentic. First dorsal origin over or behind pectoral free rear tips, its midbase considerably closer to pelvic bases than pectorals and its free rear tip slightly anterior, over, or slightly posterior to pelvic fin origins; second dorsal fin nearly or quite as large as first, its height 4/5 or more of first dorsal height, its origin about opposite or slightly anterior to anal origin; pectoral fins broad and triangular or falcate, their lengths from origin to free rear tip over 2/3 of pectoral anterior margins; pectoral origins under interspace between third and fourth gill slits; anal fin somewhat smaller than second dorsal, with preanal ridges hardly developed and a deeply notched posterior margin. Colour grey, yellow or brownish above, without a colour pattern. Large sharks, adults reaching over 3 m.

Remarks: The arrangement of this genus follows Bass, D'Aubrey & Kistnasamy (1975a) and Compagno (1979) in recognizing only two living species. Some 11 nominal species fall in this genus, but most of them can be synonymized with Carcharias acutidens Rüppell, 1837. An exception is the Atlantic Hypoprion brevirostris Poey, 1868, from which the eastern Pacific Carcharias fronto Jordan & Gilbert, 1882 may not be separable and is tentatively included as a synonym (however, S.P. Applegate, pers. comm. notes that the two are apparently separable by dentitional differences). The classification and species of Negaprion are discussed in detail in Compagno (1979).

The genus Mystidens was based by Whitley (1944) on strips of teeth from a shark from western Australia. The writer has examined the holotype of Mystidens innominatus Whitley, 1944 in the Australian Museum (Sydney), AMS IB 278, and was able to confirm his earlier hypothesis (Compagno, 1979) that these are very similar to teeth from large N. acutidens and that M. innominatus is a probable synonym of N. acutidens.

The genus Hemigaleops was based by Schultz (in Schultz et al. 1953) on a new species of shark (H. forsteri) with spiracles thought to be close to Hemigaleus, but this proved to be a Negaprion, probably N. acutidens (Garrick & Schultz, 1963; Compagno, 1979).

Key to Species:

1a. Fins, especially dorsal, pectoral and pelvic fins, usually more strongly falcate. Serrations weakly developed on blades of upper teeth in individuals 1.4 m long and larger, and absent in small individuals of 0.7 m or less. Total vertebral counts 224 to 227 .... **N. acutidens**

1b. Fins weakly falcate. Serrations regular and strong on blades of upper teeth of individuals 1.4 m long and larger, but absent in small individuals of 0.7 m or less. Total vertebral counts 197 to 206 .... **N. brevirostris**

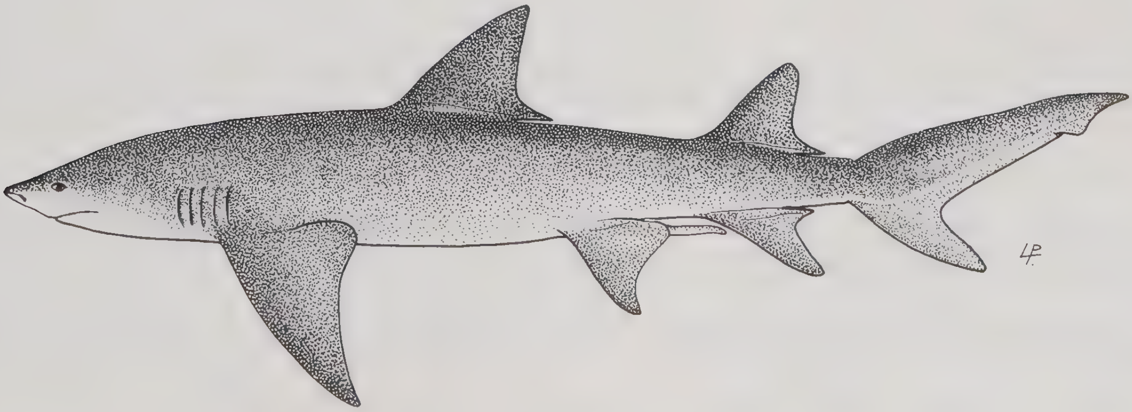
Negaprion acutidens (Rüppell, 1837)

CARCH Neg 2

Carcharias acutidens Rüppell, 1837, Neue Wirbel.Faun.Abyssinien.Fische Rothen Meeres, (11):65, pl. 18, fig. 3. Lectotype: Naturmuseums Senckenberg, SMF 2825, 680 mm stuffed specimen, designated by Klausewitz (1960:292). Type Locality: Djedda, Saudi Arabia, Red Sea.

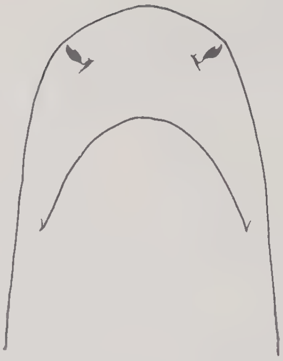
Synonymy: Carcharias munzingeri Kossmann & Raeuber, 1877; Carcharias forskaelii Hemprich & Ehrenberg, 1899; Eulamia odontaspis Fowler, 1908; Aprionodon acutidens queenslandicus Whitley, 1939; Mystidens innominatus Whitley, 1944; Hemigaleops forsteri Schultz & Welander, in Schultz et al., 1953; Odontaspis madagascariensis Fourmanoir, 1961.

FAO Names: En - Sicklefin lemon shark; Fr - Requin limon faucille; Sp - Tiburón segador.



Field Marks : A big, stocky, short-nosed, pale yellow-brown requiem shark with the second dorsal about as large as the first, and narrow, smooth-cusped teeth in both jaws. Very similar to the allopatric N. brevirostris, but usually has more falcate fins.

Diagnostic Features : Dorsal, pectoral and pelvic fins usually more strongly falcate. Serrations weakly developed on blades of upper teeth in individuals 1.4 m long and larger, and absent in small individuals 0.7 m or less. Total vertebral counts 224 to 227.



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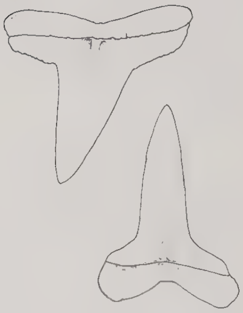
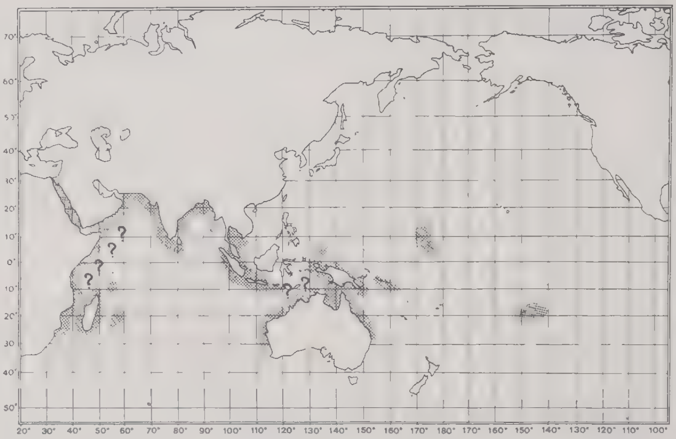


upper and lower tooth

Geographical Distribution : Indo-West and central Pacific: South Africa, Mauritius, Seychelles, Madagascar, and Red Sea east to Pakistan, India, Thailand, Viet Nam, Malaysia, Indonesia, New Guinea, Australia (Queensland, Western Australia and probably northern Australia as well), New Caledonia, The Philippines, Palau, Marshall Islands, Tahiti.



Habitat and Biology : This is a tropical inshore shark of continental and insular shelves and terraces, found on or near the bottom in the intertidal down to at least 30 m. It sometimes occurs near the surface, particularly when stimulated by food. These sharks prefer bays, estuaries, sandy plateaus, outer reef shelves at moderate depths and reef lagoons, often in turbid, still water. Young sharks are commonly found on reef flats, in water sufficiently shallow to bare their dorsal fins. That they may occasionally venture into deeper water is suggested by the appearance of one in a film ("Blue water, White Death") well offshore, possibly near a dead sperm whale being eaten by oceanic whitetip sharks (Carcharhinus longimanus).

The sicklefin lemon shark is described as a sluggish species, swimming slowly near the bottom or resting on it. It is hardy in captivity and has been kept in public aquaria and oceanaria.

Viviparous, number of fetuses in a litter 1 to 13. Depending on locality, young are born in October or November (Madagascar) or December or January (French Polynesia). Gestation period may be 10 or more months.

This lemon shark feeds on bottom-dwelling bony fishes, including porcupine fishes, and stingrays.

This shark is reported as being shy of divers and reluctant to approach them even when dead fish baits are placed to attract them. In one reported instance an adult was attracted to a dead speared grouper and repeatedly fled when divers nearby made the slightest movement, but eventually grabbed the fish in a rush after a half hour of approaches and departures; apparently this indicated strong approach-avoidance behaviour on the part of this particular lemon shark. In shallow water young sicklefin lemon sharks are said to be more aggressive and inquisitive, but the adults often leave the vicinity of divers after being approached to the limits of visibility. However, this shark responds promptly and aggressively when touched, poked, or speared, and will attack people or boats when accosted. One such attack involved a victim who sought refuge atop a coral head, but had the aroused shark circling the coral head and waiting for hours before departing. There have been instances of seemingly unprovoked attacks by this shark on divers, possibly after the divers approached too close or otherwise alarmed the shark. Because of its large size, bulky body, massive head, powerful jaws, large daggerlike teeth, and its propensity to vigorously defend itself, the sicklefin lemon shark should be treated with great respect as a dangerous species.

Size : Maximum about 310 cm, males mature at 243 cm; size at birth about 45 to 80 cm.

Interest to Fisheries : Caught in Pakistan, India, Thailand, and probably other places where it occurs, in anchored and floating gillnets and on longlines. Its meat is used fresh and dried salted for human consumption, its liver is used for vitamin oil, and its fins are processed for shark-fin soup base.

Literature : Whitley (1940); Fowler (1941); Fourmanoir (1961); Gohar & Mazhar (1964); Bass, D'Aubrey & Kistnasamy (1975a); Johnson (1978).

Remarks : Vernacular names include 'sharp-toothed shark', 'South Pacific lemon shark', and 'Arava'.

Negaprion brevirostris (Poey, 1868)

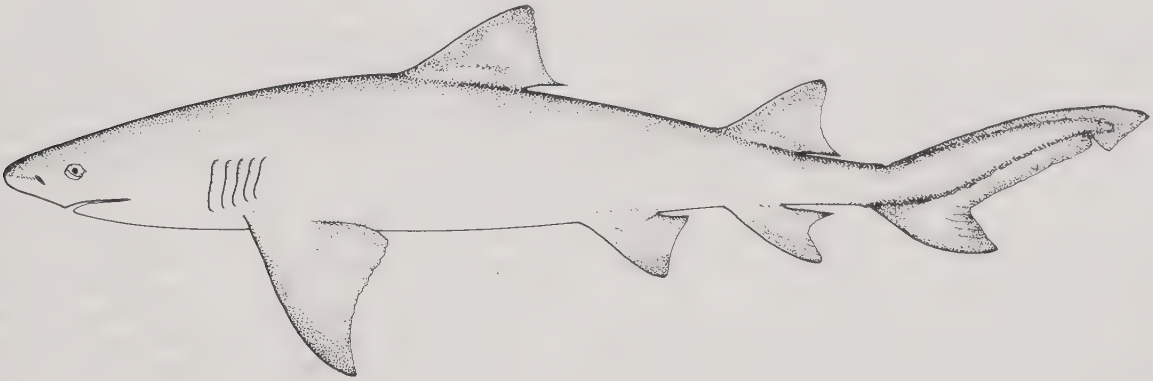
CARCH Neg 1

Hypoprion brevirostris Poey, 1868, Repert.fisico-nat.Isla Cuba, 2:451, pl. 4, fig. 5, 6, 20. Holotype: ? Type Locality: Cuba.

Synonymy : Carcharias fronto Jordan & Gilbert, 1882.

Other Scientific Names Recently in Use : Negaprion fronto (Jordan & Gilbert, 1882).

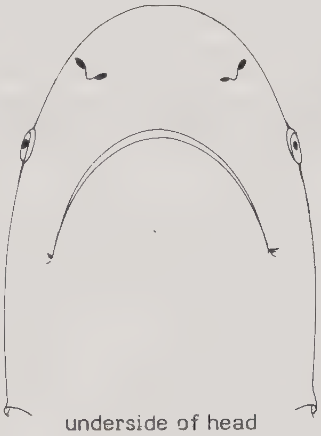
FAO Names : En - Lemon shark; Fr - Requin citron; Sp - Tiburón galano.



Field Marks : A big, stocky, short-nosed, pale yellow-brown requiem shark with the second dorsal about as large as the first, and narrow, smooth-cusped teeth in both jaws. Closely similar to the allopatric N. acutidens, but usually has less falcate fins.

Diagnostic Features : Dorsal, pectoral and pelvic fins usually weakly falcate. Serrations well-developed on blades of upper teeth in individuals 1.4 m long and larger, and absent in small individuals 0.7 m or less. Total vertebral counts 197 to 206.

Geographical Distribution : Western Atlantic: New Jersey to southern Brazil, including Gulf of Mexico, Bahamas and Caribbean. Eastern North Atlantic: Senegal, Ivory Coast (probably wide-ranging off West Africa). Eastern Pacific: Southern Baja California and Gulf of California to Ecuador.



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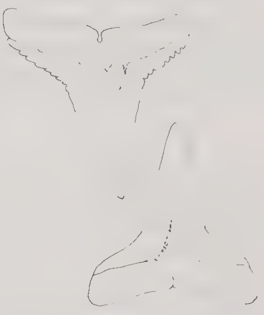
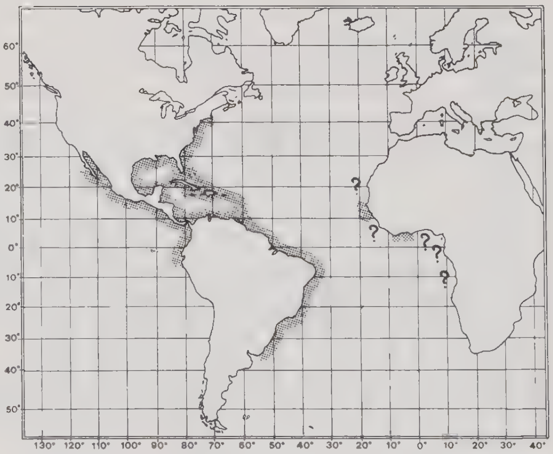


upper and lower tooth

Habitat and Biology : An abundant, coastal, inshore tropical shark of the continental and insular shelves, found from the surface and intertidal down to at least 92 m; it also occasionally ventures into the open ocean, near or at the surface, apparently for purposes of migration. It commonly occurs around coral keys, at mangrove fringes, around docks, on sand or coral mud bottoms, in saline creeks, in enclosed sounds or bays, and in river mouths. It may enter fresh water but does not penetrate far up tropical rivers as does Carcharhinus leucas. In the western North Atlantic lemon sharks are thought to be divided up into a Caribbean principal population and a Gulf of Mexico-Atlantic USA accessory population, though the principal population may use Florida as part of its nursery grounds. Individuals occur singly or form loose aggregations of up to 20 individuals, with some segregation by size and sex. Off Florida adult lemon sharks may migrate southward and into deeper water, at least in transit, at the onset of winter.



This shark is currently the subject of an intensive long-term behavioural and ecological study by Dr S.H. Gruber and associates. So far their work with sonic-tagged lemon sharks indicates that this species is active both day and night (with an average speed of slightly over 1.5 kph), but like some terrestrial predators is most active at dawn and dusk (shown by a 'speedup' to nearly 2.5 kph at these times). The lemon shark shows definite site specificity, especially in the young but to a lesser extent in adults, with a tendency in some individuals to return to the same favoured place each day. Lemon sharks tend not to passively drift with a current while moving and have been observed swimming in a set course which sometimes placed them against or across a current during a change in tidal direction. Although this species favours shallow areas, it readily can move into deeper water; one was observed to move from a reef into the Gulf Stream current and travel 100 km before returning to the shallows. With growth the sharks expand their home ranges dramatically, although still favouring shallow areas. Young sharks range over a limited space of 6 to 8 km^2 on eelgrass flats, lagoons, and other shallow areas but as they grow to subadults gradually expand their range to about 300 km^2; adults additionally occupy offshore reefs and deeper water, especially for migrations, although they readily return to the shallows.

Studies of the respiratory physiology of lemon sharks suggest that they are adapted to being active in environments with a low oxygen level, such as the waters around mangrove bays which have high temperatures and high organic content. They have circulatory and respiratory mechanisms, such as blood with an unusually high affinity for oxygen, that enhances oxygen uptake. Lemon sharks are quite capable of resting on the bottom, but use up more energy at rest than when swimming at a normal rate; probably because of increased effort in pumping their gills when resting and from decreased efficiency of oxygen uptake with lower intake velocity of water through their gills. Comparative data on oxygen consumption show that this tropical shark operates at a metabolic level some 2½ times greater than the temperate piked dogfish (Squalus acanthias).

Viviparous, with a yolk-sac placenta; number of young 4 to 17 per litter. In the western North Atlantic, mating and birth occurs in spring and summer (May to September), with a peak in spring. The gestation period is between 10 and 12 months. Off the west coast of Florida there is a seasonal increase in abundance of these sharks as males and nongravid females congregate to mate. Pregnant females enter shallow nursery areas and drop their young, which stay there for considerable lengths of time. At one time this shark was thought to be fast-growing and to reach maturity in only one to two years (Springer, 1950b), but field studies by Dr Gruber and associates have revised this to about 6½ years. A growth curve published by Gruber (1981) gives an asymptotic maximum age of about 27 years. Growth of tagged free-ranging sharks is approximately 1/4 as great as those kept in captivity and given food to satiation, suggesting that availability of food is a limiting factor in the growth and ultimately reproduction of these sharks; as well as indicating that captive studies of the growth of sharks under ideal conditions may give an incorrect impression of what occurs in free-living sharks. Courtship behaviour and copulation has occurred in captivity, and wild-caught adult female sharks have scars from bites delivered above the pelvic fins by courting adult males. Lemon sharks do very well in captivity, with young individuals being favourite subjects for physiological and behavioural studies.

The lemon shark feeds primarily on fishes but also takes crustaceans and molluscs. Prey taken includes sea catfishes, mullet, jacks, croakers, porcupine fishes, cowfish (Ostraciontidae), guitarfish, stingrays, eagle rays (Pteromylaeus), crabs, crayfish, occasional sea birds, barnacles, amphipods, and conchs. Experimental studies on captive lemon sharks by Dr Gruber and associates showed that these sharks feed to satiation and stop, that young sharks 70 cm long eat 3% of their body weight daily with unlimited food available, and that they double their weight in about 100 days. With sharks that had been starved for three days, feeding them a meal equal in weight to what they normally chose in captivity (3% body weight) resulted in almost all food being digested in their stomachs after a day, but that allowing them to feed up to 20% of their body weight resulted in undigested food being retained in some cases for over two days. Meal size apparently is important in determining the rate of digestion and perhaps the feeding frequency, as well as the rate of growth.

The lemon shark has been involved in several attacks on people on boats, often after being disturbed, hooked or harpooned. There have been some unprovoked attacks by these sharks on bathers and swimmers, but more commonly the sharks are accosted by divers or anglers, which may result in the release of a vigorous attack. Although lemon sharks are apparently not aggressive to divers when undisturbed, and do not include mammalian prey as a significant part of their diet, they should be regarded as potentially quite dangerous because of their size, powerful jaws and large teeth, and tendency to defend themselves when disturbed; and should be treated with due respect. Baiting with fish underwater or spearfishing may result in close approaches by these sharks.

Size : Maximum about 340 cm, males maturing at about 224 cm and reaching at least 279 cm, females maturing at about 239 cm and reaching at least 285 cm; size at birth 60 to 65 cm.

Interest to Fisheries : A common inshore shark widely caught where it occurs, on longlines, and probably other gear; meat utilized dried salted, smoked, and probably fresh frozen, hides for leather and other products, fins for shark-fin soup base, oil extracted from the liver for vitamins, and carcasses for fishmeal.

Literature : Springer (1938, 1940b, 1950a, 1960, 1963); Bigelow & Schroeder (1948); Cadenat (1957); Garrick & Schultz (1963); Limbaugh (1963); Randall (1963); Clark & von Schmidt (1965); Compagno & Vergara (1978); Cadenat & Blache (1981); Gruber (1981).

Remarks : Following Compagno (1979), the eastern Pacific N. fronto is synonymized with this species. The identification of the eastern Atlantic Negaprion with this species requires confirmation.

Prionace Cantor, 1849

CARCH Prion

Genus : Prionace Cantor, 1849, J.Asiatic Soc.Bengal, 18:1399. Placed on the Official List of Generic Names in Zoology by the International Commission on Zoological Nomenclature (Opinion 723.3d, 1965, Name no. 1660).

Type Species : Squalus glaucus Linnaeus, 1758, by suspension of the Rules under Opinion 723 of the International Commission on Zoological Nomenclature (1965:32).

Synonymy : Genus Thalassorhinus Valenciennes, in Bonaparte, 1838; also Valenciennes, in Müller & Henle, 1839; Genus Cynocephalus Gill, 1862 (junior homonym of Cynocephalus Boddaert, 1768 and Cynocephalus Geoffroy & Cuvier, 1795, in Mammalia); Genus Thalassinus Moreau, 1881; Genus Galeus Garman, 1913 (junior homonym of Galeus Rafinesque, 1809, Galeus Cuvier, 1817 and Galeus Leach, 1818).

Diagnostic Features : Body rather slender. Head narrow, only moderately depressed, not trowel-shaped; snout narrowly parabolic in dorsoventral view, very long, with preoral length greater than internarial space and mouth width; eyes large, without posterior notches; spiracles absent; unique papillose gillrakers present on internal gill openings; nostrils small, internarial space about 2.5 to 3 times the nostril width; anterior nasal flaps very short and broadly triangular, not tubular; labial furrows very short with uppers shorter than lowers and with their ends falling far behind eyes; teeth well differentiated in upper and lower jaws; upper and anteroposteriors with broad, triangular, curved erect to oblique, serrated cusps but with no blades or cusplets (except in very young specimens); lowers with slender cusps, no blades or cusplets, and variable serrations; cusps of lower teeth not prominently protruding when mouth is closed; 24 to 31/25 to 34 rows of teeth. Interdorsal ridge absent; low dermal keels present on caudal peduncle; upper precaudal pit transverse and crescentic. First dorsal origin well behind pectoral rear tips, its midbase much closer to pelvic than to pectoral bases, and free rear tip slightly anterior to pelvic origins; second dorsal fin much smaller than first, its height 1/2 of first dorsal height or less; its origin slightly posterior to anal insertion; pectoral fins very narrow and somewhat falcate, pectoral length from origin to free rear tip 1/2 or less of pectoral anterior margin; pectoral origins varying from under interspace between third and fourth gill slits to under fourth gill slits; anal slightly larger than second dorsal, with short preanal ridges and a deeply notched posterior margin. Colour intense deep blue above, white below, without a colour pattern. Large sharks, adults possibly reaching 4 m or more.

Remarks : The complex nomenclatural and systematic history of this genus is discussed in detail in Bigelow & Schroeder (1948) and Compagno (1979). It is generally regarded as being monotypic, with a single, extremely wide-ranging species, the blue shark (Prionace glauca). The status of Thalassorhinus and its synonym Thalassinus is discussed in Compagno (1979).

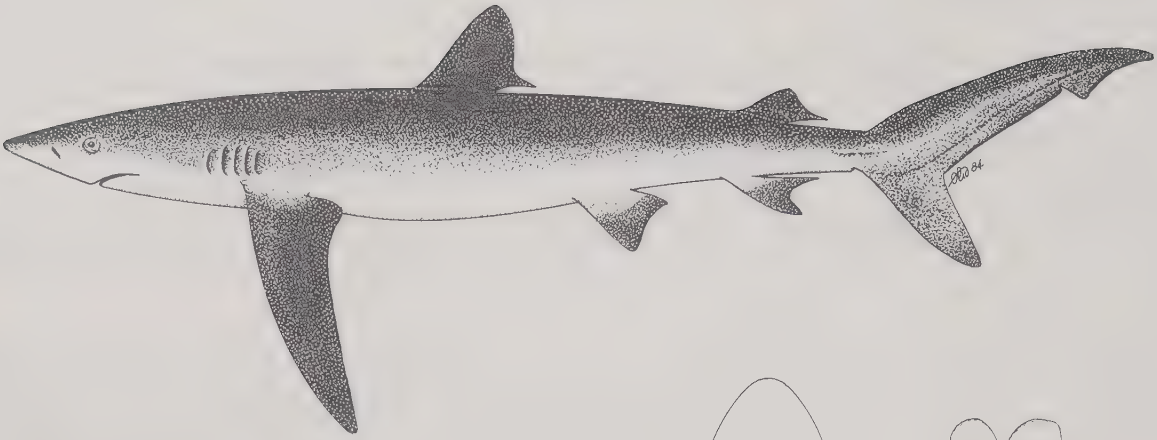
Prionace glauca (Linnaeus, 1758)

CARCH Prion 1

Squalus glaucus Linnaeus, 1758, Syst.Nat., (10)1:235. Placed on the Official List of Specific Names in Zoology by the International Commission on Zoological Nomenclature (Opinion 723.4d, 1965, name no. 2058). Holotype: None. Type Locality: "Habitat in Oceano Europaeo".

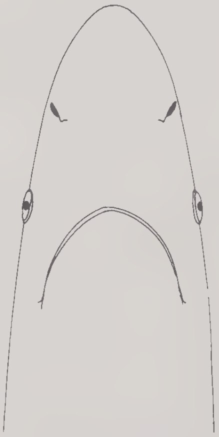
Synonymy : ? Squalus adscentionis Osbeck, 1765; ? Squalus rondeletii Risso, 1810; Squalus caeruleus Blainville, 1825; ? Galeus thalassinus Valenciennes, in Cuvier, 1835; ? Thalassorhinus vulpecula Valenciennes, in Bonaparte, 1838; also in Müller & Henle, 1839; Carcharias (Prionodon) hirundinaceus Valenciennes, in Müller & Henle, 1839; Thalassinus rondelettii Moreau, 1881; Carcharias pugae Perez Canto, 1886; Carcharias gracilis Philippi, 1887; Hypoprion / Hemigaleus isodus Philippi, 1887; ? Carcharias aethiops Philippi, 1896; Prionace macki Phillipps, 1935.

FAO Names : En - Blue shark; Fr - Peau bleue; Sp - Tiburón azul.



Field Marks : Dorsal coloration dark blue, bright blue on sides and abruptly white on the undersides, usually slender body, long snout, large eyes, gillraker papillae, long, narrow, pointed pectoral fins, short labial furrows, first dorsal fin on back but closer to the pelvic bases than the pectorals, second dorsal less than a third size of first, a weak keel on the caudal peduncle, and a narrow-lobed caudal fin with a long ventral lobe.

Diagnostic Features : See genus.



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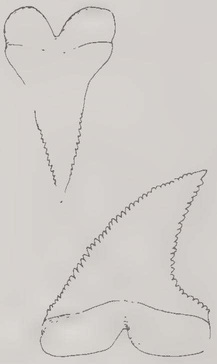
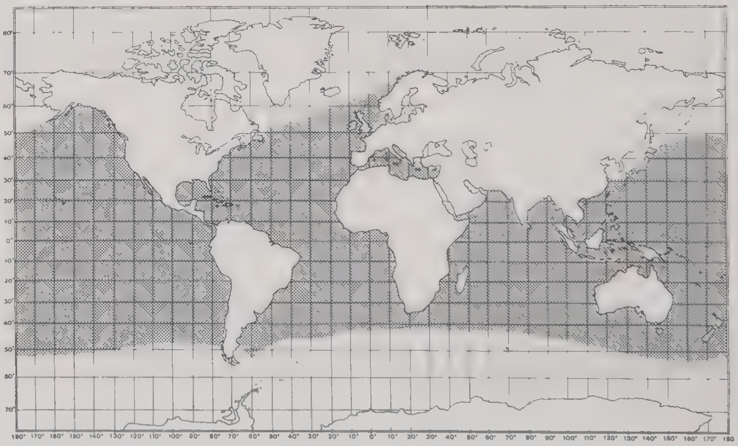


upper and lower tooth

Geographical Distribution : Oceanic and circumglobal in temperate and tropical waters (probably the widest ranging chondrichthyian): Western Atlantic: Newfoundland to Argentina. Central Atlantic. Eastern Atlantic: Norway to South Africa, Mediterranean. Indo-West Pacific: South Africa and southern Arabian Sea to Indonesia, Japan, Australia, New Caledonia and New Zealand. Central Pacific. Eastern Pacific: Gulf of Alaska to Chile.



Habitat and Biology : A wide-ranging, oceanic-epipelagic and fringe-littoral shark, occurring from the surface to at least 152 m depth. Although an offshore species, it may venture inshore, especially at night, and often in areas with a narrow continental shelf or off oceanic islands. In temperate waters blue sharks occasionally venture to the edges of kelp forests or sufficiently far inshore to be caught in pound nets. The blue shark is often found in large aggregations, not tightly organized schools, and frequently close to or at the surface in temperate waters. It prefers relatively cool water at 7° to 16°C but can tolerate water at 21°C or even more; it ranges far into the tropics but shows tropical submergence and occurs at greater depths there. In the tropical Indian Ocean the greatest abundance of blue sharks occurs at depths of 80 to 220 m, with temperatures about 12° to 25°C.

The blue shark is often seen cruising slowly at the surface, with its large pectoral fins outspread, and its first dorsal fin and terminal caudal lobe out of the water. When disturbed, hooked or attacking prey it is capable of bursts of speed; one was seen by the writer to jump partway out of the water when hooked on a pelagic longline. It will often circle a food item before moving in to devour it.

In the Pacific the blue shark is present in greatest abundance between 20° and 50°N, but in this area it shows strong seasonal fluctuations in abundance, connected with yearly migrations northward in summer and southward in winter. In the tropics between 20°N and S it is uniformly abundant throughout the year. In the North Atlantic, tagging and recapturing of individuals has shown a regular clockwise trans-Atlantic migration route with the current system there. Sharks tagged off the USA have been recovered off Spain, in the Straits of Gibraltar, and in the equatorial north-central Atlantic, while sharks tagged in the Canary Islands have turned up off Cuba. Apparently the sharks ride the Gulf Stream to Europe, take various currents down the European and African coasts, and ride the Atlantic North Equatorial Current to the Caribbean region. There is considerable sexual segregation in populations, with females more abundant at higher latitudes than males.

Viviparous, with a yolk-sac placenta; number of young 4 to 135 per litter. The number of young varies considerably among females, more so than any other livebearing shark, and may be partially dependent on size of the female. In the Indian Ocean sex ratios of fetuses were in aggregate 1:1, though individual females often have slightly more of one sex than another. The gestation period is 9 to 12 months, and possible maximum age at least 20 years. Off the western North Atlantic most female blue sharks are immature at 0 to 4 years old, adolescent at 4 to 5 years, and adult from 5 to 6 years and beyond. Males mature at about 4 to 5 years of age. Unlike some other carcharhinids, clasper growth in males is apparently a prolonged and gradual process that may take at least a year, making the condition of claspers rather difficult to use for determining maturation of males. Females have a prolonged maturation phase in their fourth and fifth years during which time they become sexually active and copulate with males. Five-year old females store sperm in their shell glands after the mating season in late spring to early winter, and retain it for a prolonged period while their ovaries and oviducts enlarge and become differentiated; in their sixth year, in the next spring, fertilization occurs and young are born in spring to early summer of their seventh year. Some females may mature a year earlier than the majority or shift out of phase with them in having young out of the usual season. Sharks in tropical areas may mate throughout the year.

Courtship behaviour and copulation has not been observed in the blue shark, but these apparently involve biting of females by males. Among adult and subadult sharks, this behaviour is sufficiently consistent with sex that sharks in the field can be sexed accurately merely by the presence or absence of bite wounds or scars. The blue shark has an unusual morphological adaptation for this behaviour; adolescent and mature females develop skin about three times as thick as males.

The blue shark feeds heavily on relatively small prey, especially bony fishes and squid, though other invertebrates, small sharks, and mammalian carrion is readily taken and seabirds occasionally are caught at the surface of the water. Much of the prey of the blue shark is pelagic, though bottom fishes and invertebrates figure in its diet also. Fish prey include herring, sardines and other clupeids, anchovies, conger eels, Pacific salmon, daggertooths (Anotopterus), lancetfish, needlefish, sauries, flyingfish and their eggs, pipefish, hake, cod, haddock, pollock, whiting and other gadoids, mullet, pomfrets, mackeral, damselfish, tuna (including bigeyes and yellowfins), jacks, remoras, sea bass, trunkfish, rockfish, spiny dogfish (Squalus acanthias) and, in one instance, a goblin shark (Mitsukurina).

Squid are a very important prey of these sharks; some species form huge breeding aggregations, which are attended by blue sharks. Some sharks slowly ingest masses of squid almost like browsing herbivores, and leisurely swim forward and sweep their heads and tails in broad arcs, catching squid at the corners of their mouths. Newly arrived and presumably hungry sharks may rapidly charge through dense schools of squid gulping down large masses. These sharks also feed on the undersides of dense schools, assuming a vertical posture and lunging upward into the school to take prey. With scattered or alert squid the sharks may attack in swift, fast turns and catch them in their mouth corners. Cuttlefish, vampire squid and pelagic octopi are also taken by blue sharks, as well as sea snails, slipper lobsters, shrimp, mantis shrimp and crabs (including swimming crabs). In the eastern North Pacific, masses of pelagic red crabs are readily eaten by these sharks. The papillose gillrakers of the blue shark, unique among the requiem sharks, may be very useful for preventing small prey like squid, red crabs or anchovies from slipping out the internal gill slits. On the other hand, these sharks proverbially gather in great numbers at a whale carcass and may feast avidly on its blubber in a feeding frenzy. Whale and porpoise blubber and meat have been recorded from blue shark stomachs. These sharks are also known to attack the cod-ends of trawls to remove the fish. Blue sharks have been seen biting at floating objects such as tin cans and boxes at the surface.

A dangerous species, with several attacks on people and boats on record. Spearfishing divers have been harassed by these sharks, and have had to fend them off with spears to keep from being bitten. Sometimes these sharks will slowly circle divers, possibly out of curiosity, in some instances for a quarter of an hour or more. An odd 'sport' for divers off southern California is swimming with blue sharks that have been baited into the vicinity of a boat, possibly as a test of virility on the part of the mostly male divers. The blue shark is not strongly aggressive under such circumstances of contact with people underwater, but on the other hand is not very timid. A slowly approaching shark of this species should be handled with caution, as it may bite (possibly in test-feeding) after circling for some time.

Size : Maximum size 383 cm on reasonably good evidence, though unconfirmed reports of larger individuals up to 4.8 to 6.5 m are mentioned in the literature; males maturing between 182 and 281 cm, and reaching at least 311 cm, females adolescent at 173 to 221 cm, adult at 221 to at least 323 cm; size at birth about 35 to 44 cm.

A length/weight equation for the blue shark (Strasberg, 1958) is: Log Wt (lbs) = -5.396 + 3.134 log TL (cm).

Interest to Fisheries : This common oceanic shark is usually caught with pelagic longlines but also hook-and-lines, pelagic trawls, and even bottom trawls near coasts. It is utilized fresh, smoked, and dried salted for human consumption; its hides are used for leather; fins for shark-fin soup base; and also for fishmeal and liver oil. This shark is also considered a game fish and taken by sports anglers with rod and reel.

Literature : Bigelow & Schroeder (1948); Strasberg (1958); Fourmanoir (1961); Garrick & Schultz (1963); Randall (1963); Stevens (1973, 1974, 1975, 1976); Feder, Turner & Limbaugh (1974); Bass, D'Aubrey & Kistnasamy (1975b); Clarke & Stevens (1975); Gubanov & Grigor'ev (1975); Compagno & Vergara (1978); Sciarotta & Nelson (1979); Casey (1979); Pratt (1979); Tricas (1979); Compagno (1979, 1981); Cadenat & Blache (1981).

Rhizoprionodon Whitley, 1929

CARCH Rhiz

Genus : Rhizoprionodon Whitley, 1929, Aust.Zool., 5(4):354. Proposed as a replacement name for Rhizoprion Ogilby, 1915.

Type Species : Carcharias (Scoliodon) crenidens Klunzinger, 1879, by original designation; a junior synonym of Carcharias acutus Rüppell, 1837.

Synonymy : Genus Rhizoprion Ogilby, 1915 (junior homonym of Rhizoprion Jourdan, 1861, in Mammalia); Genus Protozygaena Whitley, 1940.

Field Marks : Requiem sharks with long, parabolic or subangular snouts, small, wide-spaced nostrils, no spiracles, labial furrows varying from short and confined to mouth corners to rather long but falling behind eyes, fairly large eyes, oblique- and narrow-cusped small teeth in both jaws, these with distal blades and serrations variably present or absent but without cusplets, no keels on caudal peduncle, transverse crescentic precaudal pits, second dorsal fin 1/3 height of first or less, second dorsal origin far behind anal origin and about opposite its insertion, anal fin with elongated preanal ridges and a straight or slightly concave posterior margin.

Diagnostic Features : Body fairly slender to moderately stout. Head fairly broad, only moderately depressed, not trowel-shaped; snout narrowly to broadly parabolic or obtusely wedge-shaped in dorsoventral view, long, with preoral length greater than internarial space and mouth width; eyes rather large, without notches; spiracles absent; no papillose gillrakers on internal gill openings; nostrils small, internarial space about 3 to 5 times the nostril width; anterior nasal flaps very short, narrowly triangular, and not tubular; labial furrows short to rather long, with uppers shorter or longer than lowers falling far behind eyes; teeth similar in upper and lower jaws, anteroposteriors with slender oblique cusps and distal blades but no cusplets; serrations variably developed; cusps of lower teeth not prominently protruding when mouth is closed; 25 to 28/24 to 28 rows of teeth. Interdorsal ridge absent or rudimentary; no dermal keels present on caudal peduncle; upper precaudal pit transverse and crescentic. First dorsal origin usually over pectoral inner margins but sometimes slightly behind their rear tips, its midbase about equidistant between pectoral and pelvic bases or closer to the pectorals, and free rear tip usually anterior to pelvic origins but occasionally over them; second dorsal fin much smaller than first, its height 1/3 first dorsal height or less, its origin about over anal insertion; pectoral fins moderately broad and triangular, slightly falcate, pectoral length from origin to free rear tip 2/5 to 4/5 of pectoral anterior margin; pectoral origins varying from below third to below fourth gill slits; anal considerably larger than second dorsal, with very long preanal ridges and a straight or slightly concave posterior margin. Colour light grey, yellowish or brownish-grey above, without a colour pattern. Small sharks, adults not exceeding 1.3 to 1.5 m and most smaller than 1 m.

Remarks : The arrangement of this genus follows V. Springer (1964) in most details, except that the subgenus Protozygaena is not recognized (see Compagno, 1979 for a discussion of the classification and nomenclature of Rhizoprionodon and Protozygaena). Most of the species in Rhizoprionodon were formerly placed in Scoliodon, but the latter name is restricted to the very distinct S. laticaudus.

The list of species recognized below is provisional. Particularly, the allopatric species pairs R. oligolinx-taylori and R. terraenovae-porosus are not sharply distinguished and may represent in each case clinal variation within a single wide-ranging species (Compagno, 1979). F. Sotelo (pers. comm.) is working on this problem in R. terraenovae-porosus.

Key to Species (Modified from Springer, 1964) :

1a. Upper labial furrows reduced and often inconspicuous, generally less than 1% of total length and rarely up to 1.3%; uppers usually shorter than lower furrows. Tooth rows averaging fewer, counts 23 to 25/21 to 24 but mostly below 25/24

  2a. Total number of enlarged hyomandibular lateral line pores just behind mouth corners on both sides of head fewer, 7 to 16 and rarely above 14. Precaudal vertebral centra 84 to 91 .... **R. oligolinx**

  2b. Total number of enlarged hyomandibular pores greater, 15 to 22. Precaudal vertebral centra 73 to 80 .... **R. taylori**

1b. Upper labial furrows long and rather prominent, more than 1.1% of total length and usually more than 1.3%; uppers usually as long or longer than lower furrows. Tooth rows more numerous in average, counts 23 to 30/21 to 28 but mostly 25/24 or higher

3a. Teeth more numerous 27 to 30/26 to 28; total tooth rows in both jaws (combined counts) 53 to 58. Prenarial length from snout tip to incurrent apertures of nostrils usually greater, 4.5 to 6% of total length .... R. longurio

3b. Tooth less numerous, 23 to 27/22 to 26, mostly below 27/26; total tooth rows in both jaws 47 to 53, mostly below 53. Prenarial length usually less at any given size, 3.2 to 5.1% of total length

4a. Smaller sharks, attaining 64 cm total length or less. Appressed pectoral apex falling anterior to first dorsal midbase. Precaudal vertebral centra 79 to 90 and mostly above 84, outnumbering caudal centra by 5 to 20 centra; monospondylous-diplospondylous transition with last monospondylous centra only slightly longer and larger than first diplospondylous centra .... R. lalandii

4b. Larger sharks, reaching over 100 cm total length. Appressed pectoral apex falling opposite or behind first dorsal midbase. Precaudal vertebral centra 55 to 79 and equal or less in number than caudal centra; monospondylous-diplospondylous transition prominent, with last monospondylous centra much longer and larger than first diplospondylous centra

5a. Prenarial length greater, 4 to 5.4% of total length. Dorsal-pectoral ratio (length of first dorsal fin from origin to apex + length of pectoral anterior margin times 100) usually greater, 91 to 114 and mostly 100 or more .... R. acutus

5b. Prenarial length less, 3.2 to 4.5% of total length. Dorsal-pectoral ratio usually less, 81 to 104 and mostly below 100

6a. Precaudal vertebrae fewer, 58 to 66, mostly below 66 .... R. terraenovae

6b. Precaudal vertebrae more numerous, 66 to 75, most above 66 .... R. porosus

Rhizoprionodon acutus (Rüppell, 1837)

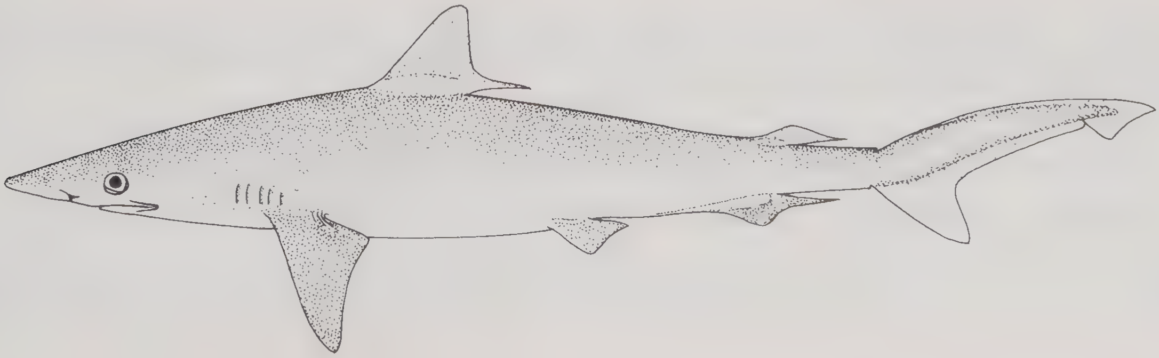
CARCH Rhiz 3

Carcharias acutus Rüppell, 1837, Neue Wirbel.Faun.Abyssienien, Fisch Rothen Meeres, (11):65, pl. 18, fig. 4. Lectotype: Naturmuseums Senckenberg, SMF 2783, 440 mm stuffed specimen, designated by Klausewitz (1960:292). Type Locality: Djedda, Red Sea.

Synonymy : Carcharias (Prionodon) sorrakowa Bleeker, 1853; Carcharias (Scoliodon) walbeehmi Bleeker, 1856 (also spelled walbenii); Carcharias (Scoliodon) crenidens Klunzinger, 1879; Carcharias aaronis Hemprich & Ehrenberg, 1899; Scoliodon longmani Ogilby, 1912; Scoliodon vagatus Garman, 1913; Carcharias eumeces Pietschmann, 1913.

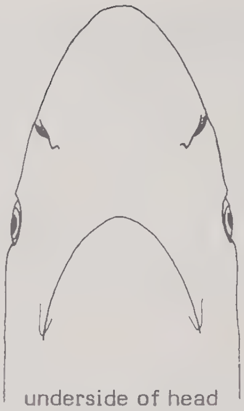
Other Scientific Names Recently in Use : Scoliodon sorrakowa (Bleeker, 1853); often spelled sorrakowah; Scoliodon walbeehmi (Bleeker, 1856).

FAO Names : En - Milk shark; Fr - Requin à museau pointu; Sp - Cazón lechoso.



Field Marks : In its area the only requiem shark with long upper and lower labial furrows, the first dorsal origin well behind the anal origin, and long preanal ridges. Key to species and diagnostic features give characters separating this from other, similar species in its genus.

Diagnostic Features : Prenarial snout 4 to 5.4% of total length; upper labial furrows long, 1.4 to 2% of total length; total count of enlarged hyomandibular pores on both sides of head just behind mouth angle usually over 16; teeth serrated in adults; teeth not well-differentiated between sexes; total tooth rows usually 25/24. First dorsal origin usually over or slightly in front of pectoral free rear tips; second dorsal origin ranges from above last third of anal base to over its insertion; pectoral anterior margin usually equal to or shorter than first dorsal length from origin to free rear tip. Posterior monospondylous precaudal centra greatly enlarged; precaudal centra usually less numerous than caudals (rarely the two are equal), precaudals 55 to 79, total centra 121 to 162. Size moderate, males maturing over 60 cm total length. Colour grey, grey-brown or purplish brown above, pale below, pectoral fins with a light margin.



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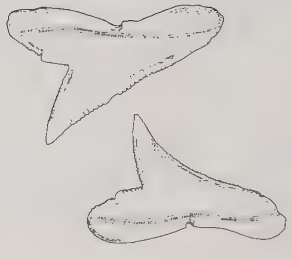
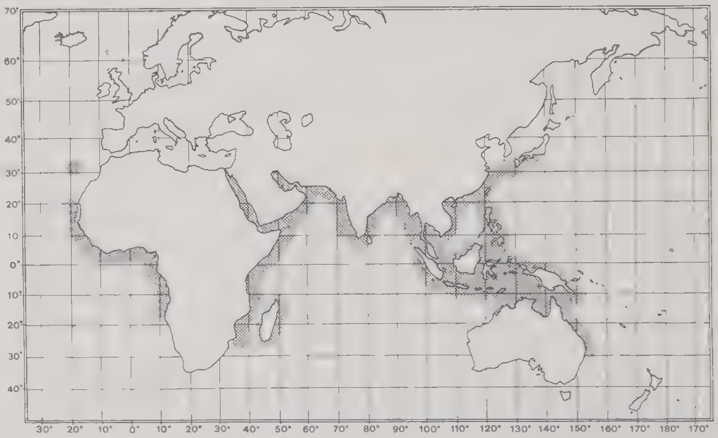


upper and lower tooth



Geographical Distribution : Eastern Atlantic: Madeira and Mauritania to Angola. Indo-West Pacific: South Africa and Red Sea to Pakistan, India, Malaysia, Indonesia, Thailand, China (including Taiwan Province), Japan, The Philippines, Australia (Queensland).

Habitat and Biology : An abundant inshore and offshore shark of continental shelves, at depths of a metre or less down to about 200 m. It often occurs off sandy beaches, in midwater or near the bottom, and sometimes in estuaries, but it does not tolerate very low salinities and does not range into fresh water. Off Natal, South Africa, numbers fluctuate throughout the year, with greatest abundance in summer.

A viviparous shark, with a yolk-sac placenta; number of young 1 to 8 per litter, usually 2 to 5. Off South Africa mating occurs in summer, young are born in summer after a gestation period of about a year, and maturation occurs at about two years of age; maximum age is at least 8 years. In the eastern Atlantic, young are also born in summer, but in winter off Bombay, India.

The milk shark feeds primarily on bony fishes but also takes cephalopods and other invertebrates. Its diet includes lizardfish, wrasses, goatfishes, sardines and herring, threadfins, hairtails, croakers, mojarras, tonguesoles, squid, octopi, cuttlefish, crabs, shrimp and sea snails.

This species is harmless to people. It is often preyed upon by larger sharks, but off Natal, South Africa, the use of gillnets to reduce the numbers of large, dangerous sharks off beaches has resulted in an increase in numbers of milk sharks through reduced predation by larger sharks.

Size : Maximum exceptionally to 178 cm, but most adults smaller, less than 1.1 m; males maturing at about 68 to 72 cm, and reaching 178 cm; females maturing at about 70 to 81 cm and reaching 165 cm; size at birth between 25 and 39 cm.

Interest to Fisheries : This is one of the most abundant sharks if not the most abundant shark in the inshore waters where it occurs, and is a ready object of artisanal and smallscale commercial fisheries as well as offshore fishing fleets. It is caught on longlines, hook-and-line, in bottom trawls, and probably other gear and utilized fresh and possibly dried salted for food and for fishmeal.

Literature : Setna & Sarangdhar (1949a); Cadenat (1957); V. Springer (1964); Nair et al. (1974); Bass, D'Aubrey & Kistnasamy (1975b); Compagno (1981); Cadenat & Blache (1981); Van der Elst (1981).

Remarks : The name 'milk shark' refers to the use of its flesh in India to promote lactation in women.

Rhizoprionodon lalandii (Valenciennes, 1839)

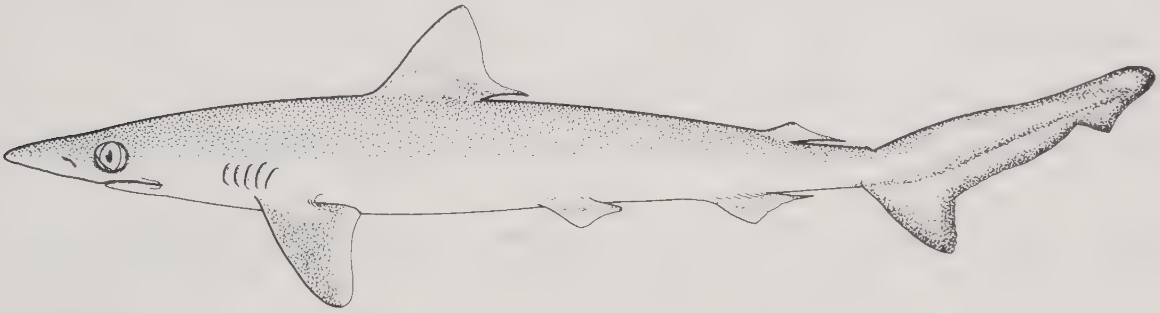
CARCH Rhiz 1

Carcharias (Scoliodon) lalandii Valenciennes, in Müller & Henle, 1839, Syst.Beschr.Plagiost., (2):30. Lectotype: Museum National d'Histoire Naturelle, Paris, MNHN 945, 303 mm, immature male, Brazil, designated by V. Springer (1964:619). Type Locality: Rio de Janeiro, Martinique, Guadeloupe.

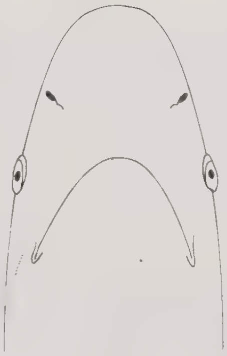
Synonymy : Scoliodon intermedius Garman, 1913.

Other Scientific Names Recently in Use : Scoliodon or Rhizoprionodon lalandei (Valenciennes, in Müller & Henle, 1839), emended spelling.

FAO Names : En - Brazilian sharpnose shark; Fr - Requin aiguille brésilien; Sp - Cazón picudo chino.



Field Marks : In its area the only requiem shark with long upper and lower labial furrows, small second dorsal fin with origin far behind anal origin, long anal ridges, and adpressed pectoral fin apex falling in front of first dorsal midbase. See key to species and diagnostic features for characters separating it from allopatric members of its genus.



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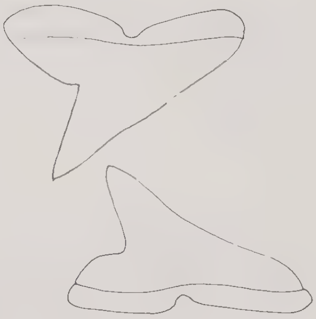
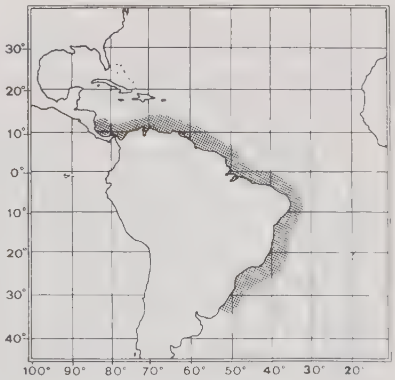


upper and lower tooth

Diagnostic Features : Prenarial snout 4.4 to 5.1% of total length; upper labial furrows long, 1.4 to 2.1% of total length; total count of enlarged hyomandibular pores on both sides of head just behind mouth angle usually over 17 (6 to 14 on each side); teeth not serrate or irregularly serrate in adults; adult males with narrower, higher, more flex-cusped anterolateral teeth than adult females or immature males; total tooth rows usually 25/24. First dorsal origin over or slightly posterior to pectoral free rear tips; second dorsal origin usually above anal insertion but occasionally over the rear fourth of its base; pectoral anterior margin usually shorter than first dorsal length from origin to free rear tip; adpressed pectoral apex reaching to below first third of first dorsal base or falling behind it. Posterior monospondylous precaudal centra slightly enlarged; precaudal centra more numerous than caudals, precaudals 79 to 90, total centra 153 to 168. Size moderately small, males maturing at about 50 cm total length. Body dark grey or grey-brown above, light below, pectorals with light margins, dorsals dusky.

Geographical Distribution : Western Atlantic: Panama to southern Brazil.



Habitat and Biology : A common tropical littoral shark of the South American continental shelf, at depths of 3 to 70 m; prefers muddy and sandy bottoms, and not normally found in lagoons and estuaries.

Development viviparous, with a yolk-sac placenta; number of young 1 to 4 per litter. Mating season in summer.

Eats small bony fishes, including sardines and anchovies, as well as shrimp and squid.

Size : Maximum about 77 cm, males maturing between 45 and 50 cm and reaching 64 cm, adult females 54 to at least 77 cm; size at birth 33 to 34 cm.

Interest to Fisheries : Fished in shallow water where it occurs, with bottom longlines, trammelnets, and probably other gear, and utilized dried salted for human consumption.

Literature : V. Springer (1964); Sadowsky (1967); Compagno & Vergara (1978).

Rhizoprionodon longurio (Jordan & Gilbert, 1882)

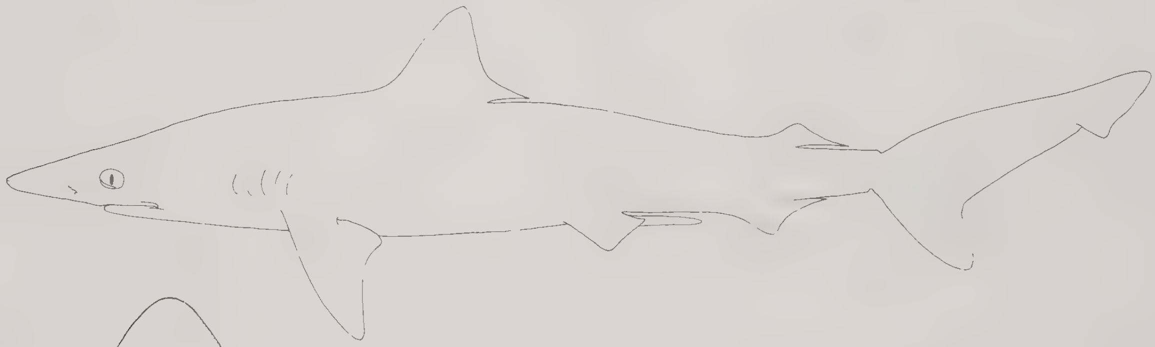
CARCH Rhiz 5

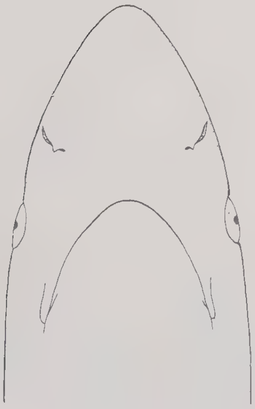
Carcharias (Scoliodon) longurio Jordan & Gilbert, 1882, Proc.U.S.Nat.Mus., 5:106. Holotype: Three syntypes in U.S. National Museum of Natural History collections: USNM 28306, 517 mm female, USNM 28330, 792 mm adult male, and USNM 29551, 518 mm female, all from Pacific Mexico. Type Locality: Mazatlan, Mexico, eastern Pacific.

Synonymy : None.

Other Scientific Names Recently in Use : Scoliodon longurio (Jordan & Gilbert, 1882).

FAO Names : En - Pacific sharpnose shark; Fr - Requin bironche; Sp - Cazón picudo pacífico.





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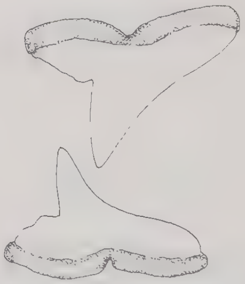
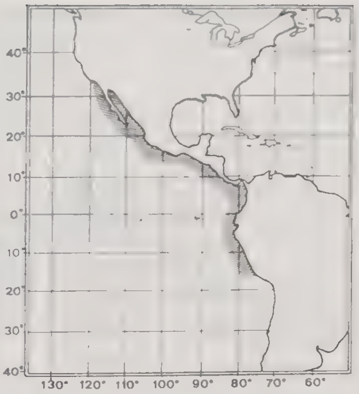


upper and lower tooth

Field Marks : The only requiem shark in the eastern Pacific with long labial furrows and a second dorsal origin well behind the anal origin. See key to species and diagnostic features for characters separating it from other members of its genus.

Diagnostic Features : Prenarial snout 4.5 to 6% of total length; upper labial furrows long, 2.1 to 2.6% of total length; total count of enlarged hyomandibular pores on both sides of head just behind mouth angle usually over 16 (8 to 15 on each side); teeth with serrated edges in adults; teeth not differentiated between sexes; total tooth rows usually 27 to 29/26 to 28. First dorsal origin usually over or slightly in front of pectoral free rear tips; second dorsal origin above last third of anal base in front of its insertion; pectoral anterior margin usually equal to or shorter than first dorsal length from origin to free rear tip; adpressed apex of pectoral reaches anterior third or two-thirds of first dorsal base. Posterior monospondylous precaudal centra greatly enlarged; precaudal centra variably 12 less to 8 more than caudals, precaudals 68 to 86, total counts 146 to 167. Size moderate, males maturing over 60 cm total length. Colour grey or grey-brown above, white below, pectoral fins with light edges, dorsals with dusky tips.



Geographical Distribution : Eastern Pacific: Southern California to Peru.

Habitat and Biology : An abundant but little-known tropical littoral shark of the continental shelves of the eastern Pacific, found at depths from the intertidal to at least 27 m depth.

Size : Maximum at least 110 cm and possibly to 154 cm, males maturing between 58 and 69 cm and reaching at least 92 cm, adult femlaes 103 to possibly 154 cm; size at birth between 33 to 34 cm.

Interest to Fisheries : A locally abundant shark, in some areas (as in the Gulf of California) one of the most abundant if not the most abundant of inshore sharks; fished by longline and probably other gear and utilized fresh or fresh frozen for human consumption and also for fishmeal.

Literature : Beebe & Tee-Van (1941); V. Springer (1964); Kato, Springer & Wagner (1967).

Rhizoprionodon oligolinx Springer, 1964

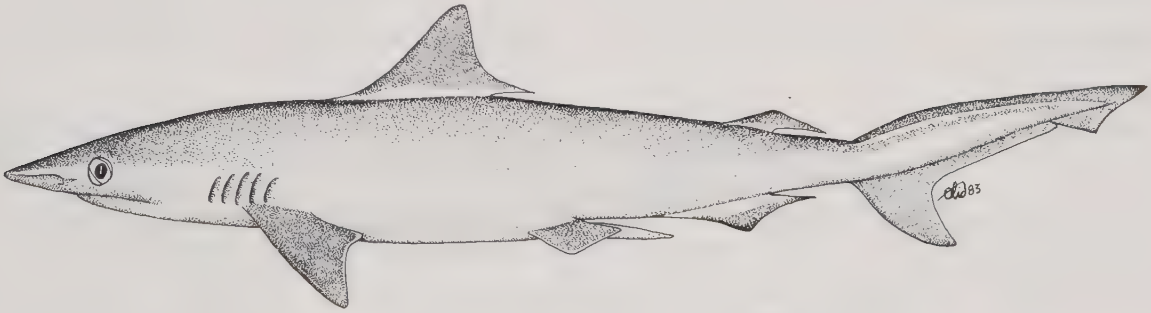
CARCH Rhiz 4

Rhizoprionodon oligolinx Springer, 1964, Proc.U.S.Natl.Mus., 115(34930):621, figs 12-23, pl. 2C. Holotype: U.S. National Museum of Natural History, USNM 196799, 489 mm adult male, formerly in George Vanderbilt Foundation collection, GVF 2467. Type Locality: Gulf of Thailand, depth from 0 to 10 m.

Synonymy : None.

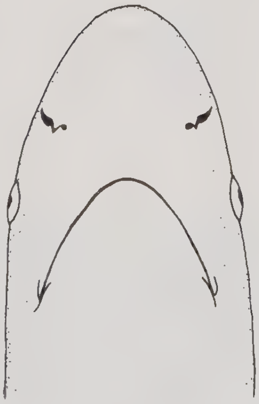
Other Scientific Names Recently in Use : Scoliodon palasorrah (not Carcharias (Prionodon) palasorrah Bleeker, 1853, a junior synonym of Scoliodon laticaudus).

FAO Names : En - Grey sharpnose shark; Fr - Requin aiguille gris; Sp - Cazón picudo gris.



Field Marks : See key to species and diagnostic features.

Diagnostic Features : Prenarial snout 3.7 to 4.7% of total length; upper labial furrows long, 0.3 to 1.3% of total length; total count of enlarged hyomandibular pores on both sides of head just behind mouth angle usually less than 16 (3 to 8 per side); tooth edges not regularly serrate; anterolateral teeth of adult males with slenderer, higher, more flexed cusps than females or immature males; total tooth rows usually 23 to 25/21 to 24. First dorsal origin over of just behind pectoral free rear tips; second dorsal origin ranges from above last third of anal base to just in front of its insertion; pectoral anterior margin shorter than first dorsal length from origin to free rear tip; adpressed pectoral apex reaching below first third of first dorsal base or falling in front of it. Posterior monospondylous precaudal centra hardly enlarged; precaudal centra more numerous than caudals, precaudals 84 to 91, total counts 151 to 164. Size small, males maturing at under 38 cm total length. Colour grey or brownish-grey above, pale below, bronzy when fresh, fins with dusky edges but not conspicuously marked.



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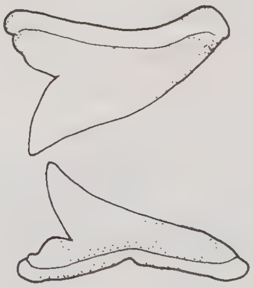
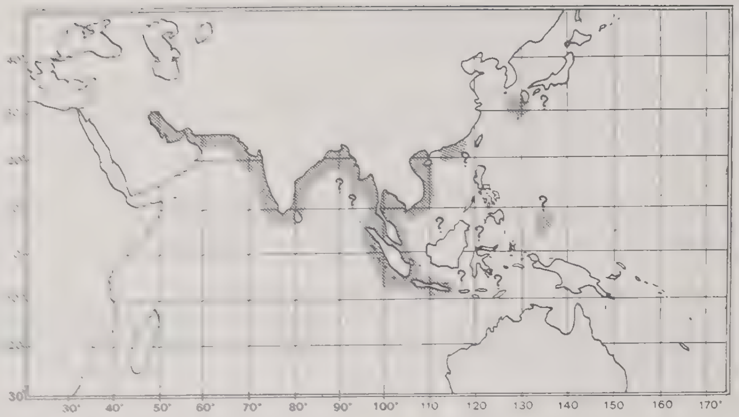


upper and lower tooth



Geographical Distribution: Indo-West Pacific: The "Gulf" between the Arabian Peninsula and Iran and Pakistan to India, Sri Lanka, Malaysia, Singapore, Thailand, Kampuchea, Sumatra, Java, Madura Straits, ?China, ?Japan, Palau Islands (Angaur Island).

Habitat and Biology: A common but little-known littoral, inshore and offshore tropical shark of the continental and insular shelves. Viviparous, with a yolk-sac placenta; number of young 3 to 5 per litter. In Bombay waters, most are born in winter (January to February).

Size: Maximum 70 cm; males maturing between 29 and 38 cm and reaching 61 cm, females maturing between 32 and 41 cm and reaching 70 cm; size at birth between 21 and 26 cm.

Interest to Fisheries: A common fisheries species off India, Pakistan, Sri Lanka and Thailand; taken with gillnets and line gear and utilized fresh and probably dried salted for human consumption.

Literature: Setna & Sarangdhar (1949); V. Springer (1964); Nair, Appukuttan & Rajapandian (1974).

Remarks: This species is close to R. taylori, but is apparently geographically separated from it as presently known. The author follows Springer (1964) in recognizing this species as separate from R. taylori.

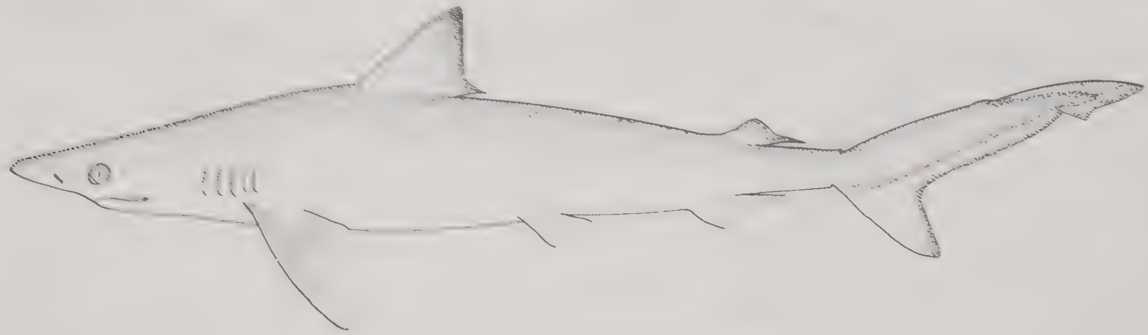
Rhizoprionodon porosus (Poey, 1861)

CARCH Rhiz 2

Squalus porosus Poey, 1861, Memorias, 2:339, pl. 19, figs 11-12. Holotype: Unknown, 815 mm male (presumably adult) mentioned. Type Locality: Cuba.

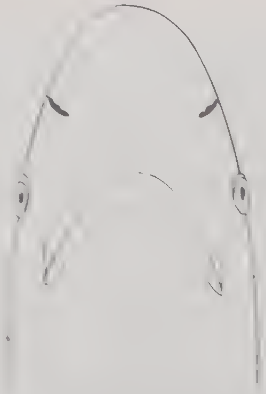
Synonymy: None.

FAO Names: En - Caribbean sharpnose shark; Fr - Requin aiguille antillais; Sp - Cazón picudo antillano.



Field Marks: See key to species and diagnostic features.

Diagnostic Features: Prenarial snout 3.3 to 4.5% of total length; upper labial furrows short, 1.3 to 2.3% of total length; total count of enlarged hyomandibular pores on both sides of head just behind mouth angle usually over 17 (9 to 19 on each side); teeth with serrations in adults; dentitions not differentiated between the sexes; total tooth rows usually 25/24. First dorsal origin usually over or slightly behind pectoral free rear tips; second dorsal origin ranging from above anal midbase to over rear fourth of its base; pectoral anterior margin usually longer than first dorsal length from origin to free rear tip; adpressed pectoral apex reaching behind first third of first dorsal base. Posterior monospondylous precaudal



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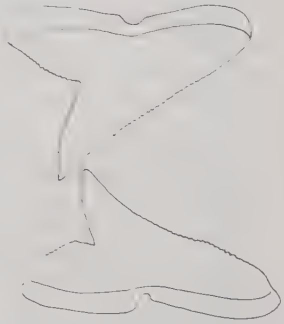
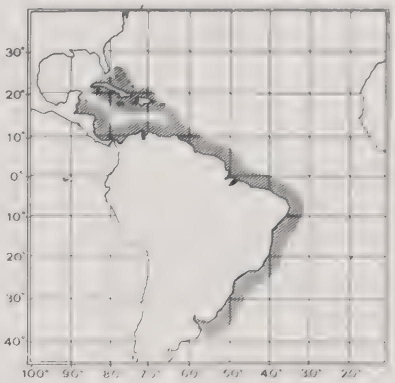


upper and lower tooth

centra moderately enlarged; precaudal centra less numerous than caudals, precaudals 66 to 75, total counts 136 to 159. Size moderate, males maturing at over 58 cm total length. Colour brown or grey-brown above, white below, sometimes with white spots on sides and white-edged fins.

Geographical Distribution : Western Atlantic: Bahamas, Cuba, Jamaica, Hispanola, Puerto Rico, Virgin Islands, Martinique, Honduras, Panama, Venezuela, Brazil, Uruguay.



Habitat and Biology : An abundant tropical littoral shark, usually found close inshore on the continental and insular shelves of the Caribbean and South America, but also found in offshore waters down to 500 m depth; one was caught near the surface in water 6036 m deep, well offshore, but this is exceptional.

Viviparous, with a yolk-sac placenta; number of young 2 to 6. Gestation period about 10 to 11 months; gives birth in the spring or early summer off southern Brazil.

Mostly eats small bony fishes, including wrasses, but also marine snails, squid and shrimp.

Size : Maximum about 110 cm, males maturing at about 60 cm and reaching at least 85 cm, females maturing at about 80 cm and reaching at least 108 cm; size at birth about 31 to 39 cm.

Interest to Fisheries : One of the commonest, if not the most common, inshore sharks where it occurs, and a regular object of artisanal and commercial fisheries. It is caught mainly with floating longlines but also bottom trawls (especially shrimp trawls), trammelnets, and probably hook-and-line. It is used salted or frozen for human consumption and processed into fishmeal.

Literature : V. Springer (1964); Sadowsky (1967); Randall (1967); Compagno & Vergara (1978).

Remarks : It is uncertain whether this Caribbean, Central and South American species is separable from the northern R. terraenovae which is allopatric to it, or instead represents a southern and Caribbean subspecies of terraenovae or a clinal variant of it. Springer (1964) gives reasons for recognizing the species, which are tentatively followed here pending detailed studies of the terranovae-porosus group of Rhizoprionodon along the coasts of Central and South America.

Rhizoprionodon taylori (Ogilby, 1915)

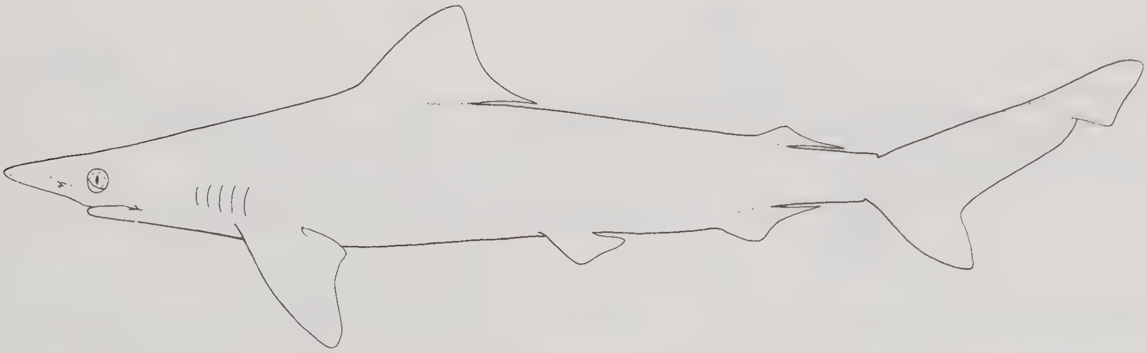
CARCH Rhiz 6

Physodon taylori Ogilby, 1915, Mem.Queensland Mus., 3:117. Holotype: Queensland Museum, 112/738, 637 mm, apparently lost. Type Locality: Townsville, northern Queensland.

Synonymy : None.

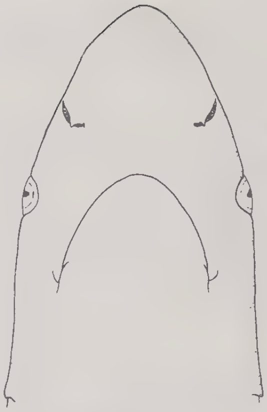
Other Scientific Names Recently in Use : Protozygaena taylori (Ogilby, 1915).

FAO Names : En - Australian sharpnose shark; Fr - Requin aiguille réchine; Sp - Cazón picudo australiano.



Field Marks : See key to species and diagnostic features.

Diagnostic Features: Prenarial snout 4 to 5% of total length; upper labial furrows short, 0.7 to 1.1% of total length; total count of enlarged hyomandibular pores on both sides of head just behind mouth angle usually over 16 (7 to 11 per side); teeth not serrate; total tooth rows usually 24 to 25/21 to 23. First dorsal origin over pectoral free rear tips; second dorsal origin ranges from above last fourth to sixth of anal base; pectoral anterior margin shorter than first dorsal length from origin to free rear tip; adpressed pectoral apex reaching first third of first dorsal base or ending in front of it. Posterior monospondylous precaudal centra hardly enlarged; precaudal centra less numerous than caudals, precaudals 73 to 80, total counts 135 to 149. Size small, males maturing over 40 cm total length. Colour brownish-grey above, white below, fins light-edged but not conspicuously marked.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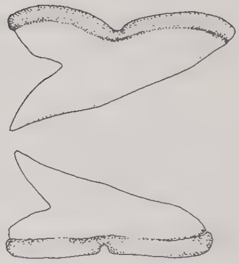
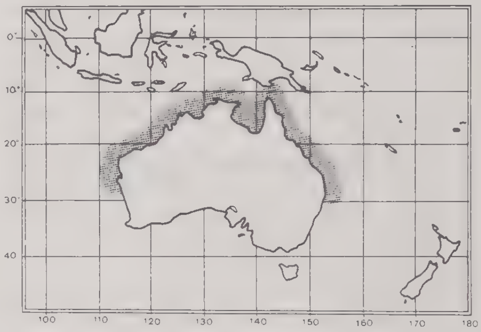

upper and lower tooth

Geographical Distribution: Western South Pacific: Australia (Western and northern Australia, Queensland).



Habitat and Biology: A little-known but common tropical inshore shark of the Australian continental shelf. Viviparous, with a yolk-sac placenta; number of young 2 per litter.

Size: Maximum about 67 cm, males adolescent at about 41 cm.

Interest to Fisheries: Apparently very common and taken in mackeral nets, but utilization not recorded.

Literature: Whitley (1940); V. Springer (1964).

Rhizoprionodon terraenovae (Richardson, 1836)

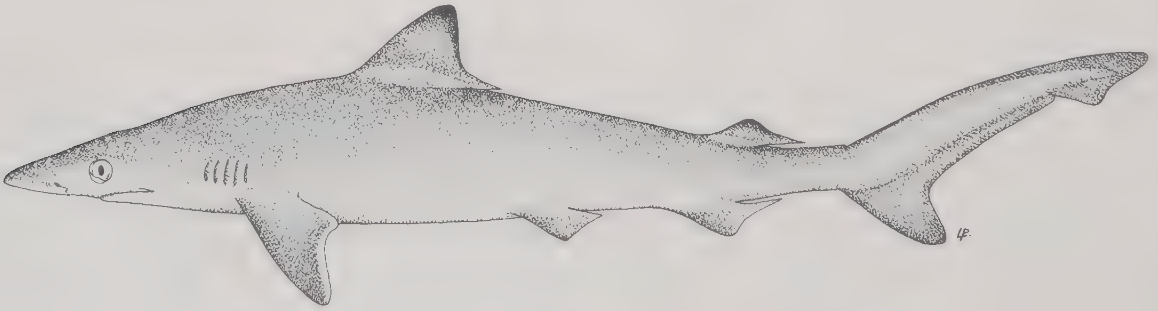
CARCH Rhiz 7

Squalus (Carcharias) terrae novae Richardson, 1836, Fauna Boreali Americana, 3:289. Holotype: None? Type Locality: Newfoundland.

Synonymy: None.

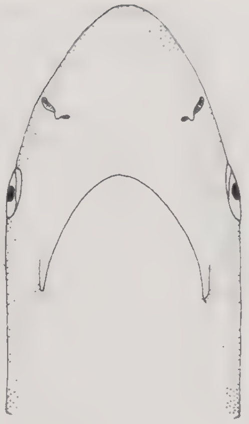
Other Scientific Names Recently in Use: Scoliodon terraenovae (Richardson, 1836).

FAO Names: En - Atlantic sharpnose shark; Fr - Requin aiguille gussi; Sp - Cazón picudo atlántico.



Field Marks: See key to species and diagnostic features.

Diagnostic Features : Prenarial snout 3.6 to 4.5% of total length; upper labial furrows long, 1.6 to 2.2% of total length; total count of enlarged hyomandibular pores on both sides of head just behind mouth angle usually over 16 (8 to 18 per side); teeth serrate in adults; teeth not differentiated in males and females; total tooth rows usually 25/24. First dorsal origin usually over or slightly in front of pectoral free rear tips; second dorsal origin ranges from above anal midbase to just in front of its insertion; pectoral anterior margin usually longer than first dorsal length from origin to free rear tip; adpressed pectoral apex reaching behind first third of first dorsal base. Posterior monospondylous precaudal centra enlarged; precaudal centra less numerous than caudals, precaudals 58 to 66, total centra 126 to 144. Size moderate, males maturing over 64 cm total length. Colour grey or grey-brown, white below, large specimens with small light spots, pectorals with white margins, dorsals with dusky tips.



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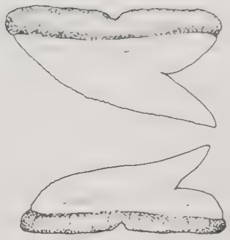
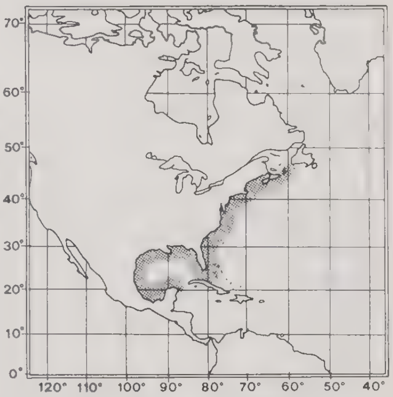


upper and lower tooth

Geographical Distribution : Western North Atlantic: New Brunswick to Florida, Gulf of Mexico.



Habitat and Biology : An abundant small coastal warm-temperate and tropical shark of the continental shelves; ranging from the intertidal to possibly 280 m deep, but usually in water less than 10 m deep. It often occurs close to the surf zone off sandy beaches, and also enclosed bays, sounds, harbours, and marine to brackish estuaries. It readily tolerates reduced salinities in estuaries and river mouths but does not penetrate far into fresh water. In the northern Gulf of Mexico it shows a regular inshore-offshore seasonal migration, retreating to deeper water with the onset of winter in October or November and returning inshore in spring, April and May.

Viviparous, with a yolk-sac placenta; number of young 1 to 7 per litter, most commonly 4 or 6 per litter, with larger females carrying more young; the sex ratio of near term fetuses is 1:1. Off Texas, Florida and North Carolina young are born in late spring and summer (June to August). In the Gulf of Mexico mating occurs in late spring to summer, mid-May to mid-July, and are born in May or June after a 10 to 11 month gestation period. Gravid female sharks move into inshore waters to deposit their young, and in the northern Gulf of Mexico outnumber adult males by nearly 3:1.

Feeds on small bony fishes, including menhaden and other clupeids, snake eels, silversides, wrasses, small jacks, croakers, mojarras, toadfish, filefish, shrimp, crabs, segmented worms and molluscs (gastropod feet). It is harmless to people.

Size : Maximum at least 110 cm, males maturing between 65 and 80 cm and reaching at least 103 cm, females maturing at 85 to 90 cm and reaching 110 cm; size at birth about 29 to 37 cm.

Interest to Fisheries : A common inshore shark, fished in Mexican waters for food.

Literature : Bigelow & Schroeder (1948); Baughman & Springer (1950); V. Springer (1964); Clark & von Schmidt (1965); Parsons (1983).

Scoliodon Müller & Henle, 1837

CARCH Scol

Genus : Scoliodon Müller & Henle, 1837, Ber.Akad.Wiss.Berlin, 114.

Type Species : Scoliodon laticaudus Müller & Henle, 1838, by subsequent monotypy.

Synonymy : Genus Physodon Valenciennes, in Bonaparte, 1838; also Subgenus Physodon Valenciennes, in Müller & Henle, 1839.

Diagnostic Features: Body moderately stout. Head broad, greatly depressed, and trowel-shaped; snout parabolic or bell-shaped in dorsoventral view, very long, with preoral length greater than internarial space and mouth width; eyes small, without posterior notches; spiracles absent; no papillose gillrakers on internal gill openings; nostrils small, internarial space about 4 to 6 times nostril width; anterior nasal flaps very short, narrowly triangular, and not tubular; labial furrows very short to rudimentary, with uppers shorter than lowers and falling far behind eyes; teeth similar in upper and lower jaws, anteroposteriors with slender oblique cusps and distal blades but no cusplets or serrations; cusps of lower teeth not prominently protruding when mouth is closed; 25 to 33/24 to 34 rows of teeth. Interdorsal ridge absent or rudimentary; no dermal keels present on caudal peduncle; upper precaudal pit transverse and crescentic. First dorsal origin over or behind pectoral rear tips, its midbase much closer to pelvic bases than to pectorals and its free rear tip about over pelvic midbases; second dorsal fin much smaller than first, its height 1/3 of first dorsal height or less, its origin behind anal midbase; pectoral fins very broad and triangular, not falcate, pectoral length from origin to free rear tip about equal to pectoral anterior margin; pectoral origins under interspace between fourth and fifth gill slits; anal fin much larger than second dorsal, with short preanal ridges and a straight or slightly concave posterior margin. Colour light grey, yellowish or brownish grey above, without a colour pattern.

Remarks: The arrangement of this genus follows Springer (1964). See Compagno (1979) for a comprehensive account of the classification, nomenclature and relationships of the genus. *Scoliodon* is apparently the sister group of the hammerhead family Sphyrnidae, but is retained in the Carcharhinidae because it lacks all of the more extreme derived character states of hammerheads.

Scoliodon laticaudus Müller & Henle, 1838

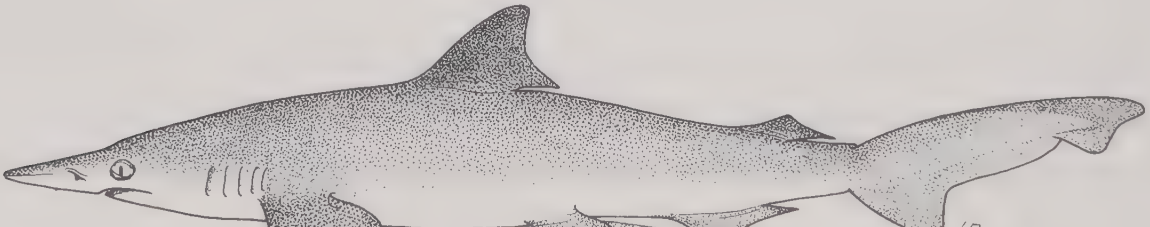
CARCH Scol 1

Scoliodon laticaudus Müller & Henle, 1838, *Syst.Beschr.Plagiost.*, (1):27; reassigned as *Carcharias (Scoliodon) laticaudus* Müller & Henle, 1839, *Ibid*, (2):28, pl.8. Holotype: A single specimen, Zoologisches Museum, Berlin, ISZZ 7830, 420 mm (stuffed specimen) was mentioned in Müller & Henle's initial account of this species (*Plagiostomen*, (1):27, 1838), making it the presumptive holotype; however, additional specimens preserved in alcohol in the Museum National d'Histoire Naturelle, Paris, were mentioned to their emended description of the species (*Plagiostomen*, (2):28, 1839). Springer (1964) selected one of these Paris specimens, MNHN 1123, 518 mm adult female, as a lectotype. Type Locality: "Aus Indien".

Synonymy: *Carcharias (Physodon) muelleri* Valenciennes, *in* Müller & Henle, 1839; *Carcharias (Scoliodon) macrorhynchos* Bleeker, 1852; *Carcharias (Prionodon) palasorra* Bleeker, 1853.

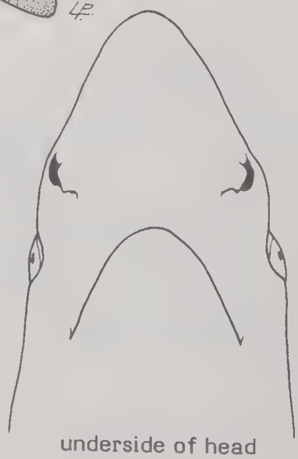
Other Scientific Names Recently in Use: *Physodon muelleri* (Valenciennes, *in* Müller & Henle, 1839); *Scoliodon palasorra* (Bleeker, 1853); *Carcharias sorrakowah* "Cuvier, 1817" (not *Carcharias (Prionodon) sorrakowa* Bleeker, 1856, = *Rhizoprionodon acutus*).

FAO Names: En - Spadenose shark; Fr - Requin épée; Sp - Cazón espadachín.



Field Marks: A small, unmistakable requiem shark, with a very long, flat, laterally expanded, spadelike snout, small eyes, small, smooth-edged bladelike teeth with oblique cusps, distal blades, and no cusplets, a stocky compressed body, short, broad triangular pectoral fins, the first dorsal fin well rearward on the back with its rear tip about over the pelvic midbases, the second dorsal fin much smaller than the first and with its origin well behind the anal origin, the anal fin much larger than the second dorsal and with a straight posterior margin and a base without long preanal ridges, and a caudal fin with its postventral margin only moderately concave, not deeply notched. It is bronzy grey above, white below, without conspicuous markings.

Diagnostic Features: See genus.



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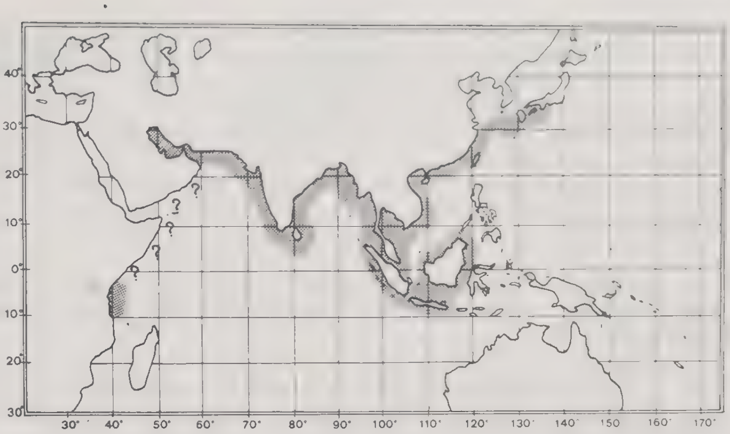
Geographical Distribution : Indo-West Pacific: Tanzania, Pakistan India, Sri Lanka, Malaysia, Singapore, Thailand, Java, Borneo, China, Taiwan Island, Japan. Apparently absent from Australasia and Oceania.



Habitat and Biology : A common tropical shark of continental and insular shelves close inshore, frequently in rocky areas. Often very abundant in its range and occurring in large schools. The spadenose shark is very common in the lower reaches of tropical rivers of Malaysia, Sumatra and Borneo, but it is uncertain if the species can live in perfectly fresh water for extended periods like Carcharhinus leucas. Unfortunately, salinity data for riverine records of this species is not available.

Viviparous, with an unusual columnar placenta. Fertilized eggs are unusually small, 1 mm in diameter and with little yolk. Developing embryos apparently derive very little of their nutriment from yolk, have no yolk in their developed yolk sacs, and establish a placental connection with the maternal uterus extremely early in their development. Thus embryos and fetuses are nourished by the mother during the entire gestation period, through the placenta and numerous long appendiculae on the umbilical cord. Litter size varies from 1 to 14, and size at birth between 13 and 15 cm. In Malaysian waters these sharks apparently can breed all year; females have embryos of various sizes, and males have mature sperm throughout the year. From length frequency data collected from about 1900 individuals of this species landed in Bombay, Nair (1976) derived age classes and growth curves and estimated average sizes at ages from 1 to 5 years. His data indicates that both sexes mature between 1 and 2 years old and reach a maximum age of about 5 years for the largest known males and at least 6 for the largest females.

Eats small pelagic schooling and bottom-living bony fishes, including anchovies, codlets (Bregmacerotidae), burrowing gobies (Tripauchenidae) and Bombay ducks (Harpadontidae), as well as shrimp and cuttlefish. Harmless to people.

Size : Maximum about 74 cm, but most individuals smaller; still larger individuals up to 120 cm have been reported but need to be verified; males maturing at 24 to 36 cm and reaching 58 cm; adult females maturing at 33 to 35 cm and reaching at least 69 cm; size at birth 12 to 15 cm, averaging about 14 cm.

Interest to Fisheries : An abundant species in Indian and Pakistani waters, commonly taken in artisanal and commercial fisheries. Caught with hook-and-line, longlines, floating and bottom gillnets and set bottom nets, and traps. Utilized fresh for human consumption, processed into fishmeal, and used for bait for other sharks and bony fishes.

Literature : Thillayampalam (1928); Setna & Sarangdhar (1948); Springer (1964); Nair, Appukuttan & Rajapandian (1974); Nair (1976); Teshima, Ahmad & Mizue (1978); Taniuchi (1979); Compagno (1979).

Triaenodon Müller & Henle, 1837

CARCH Tria

Genus : Triaenodon Müller & Henle, 1837, Ber.Akad.Wiss.Berlin, 117.

Type Species : Triaenodon obesus Müller & Henle, 1837, by subsequent monotypy in Bonaparte (1838:212); also by subsequent designation of Gill (1862:401).

Synonymy : None.

Diagnostic Features : Body moderately slender. Head very broad and flattened but not trowel-shaped; snout broadly rounded or almost wedge-shaped in dorsoventral view and very short, with preoral length subequal to internarial space and much less than mouth width; eyes fairly small, usually with posterior notches; spiracles usually absent, or present as minute pore- or slitlike openings; no papillose gillrakers on internal gill openings; nostrils small, internarial space about 3 times the nostril width; anterior nasal flaps slightly elongated, distally truncated, and forming distinct tubes with the mesonarial flaps; labial furrows very short, essentially confined to mouth corners, with uppers shorter than lowers and with their ends falling far behind eyes; teeth similar in upper and lower jaws; anteroposteriors in both jaws with erect to semioblique, narrow cusps, strong, high proximal and distal cusplets, but no blades or serrations; cusps of lower teeth not protruding when mouth is closed; 42 to 50/42 to 48 rows of teeth. Interdorsal ridge absent; no lateral keels on caudal peduncle; upper precaudal pit transverse and crescentic. First dorsal origin well behind pectoral free rear tips, its midbase much closer to pelvic bases than pectorals and free rear tip slightly anterior, over, or slightly posterior to pelvic fin origins; second dorsal fin very large but distinctly smaller than first, its height 1/2 to 3/4 of first dorsal height; its origin about opposite or slightly anterior or posterior to anal origin; pectorals fin fairly broad and triangular, their lengths from origin to free rear tip between 3/5 to 2/3 of pectoral anterior margins; pectoral origins varying from under interspace between fourth and fifth gill slits to about under fifth gill slits; anal fin about as large as second dorsal, with short preanal ridges and a deeply notched posterior margin. Colour grey or brownish above, without a colour pattern other than variable dusky spots and brilliant white fin tips. Moderate-sized sharks, adults possibly reaching 2.2 m.

Remarks : This genus has often been placed in the Triakidae but is clearly referable to the Carcharhinidae (see Compagno, 1973c, 1979 for discussion). The genus is reviewed in Taniuchi (1975), Randall (1977) and Compagno (1979).

Previous workers have often recognized two species of *Triaenodon*, *T. obesus* (Rüppell, 1837) and *T. obtusus* Day, 1878. Both Randall (1977) and the writer (1979) tentatively accepted the validity of *T. obtusus* but were unable to examined its holotype at the time. In 1982 the writer studied the holotype and only specimen, ZSI 2277, 48 cm male, a skin in alcohol in the Zoological Survey of India, Calcutta. This proved to be a full-term fetus, with erupting denticles and an umbilical scar, that is probably referable to *Carcharhinus amboinensis*, but which had been confused with *Triaenodon* because its very first erupting series of teeth somewhat resemble *Triaenodon* teeth in having a simple cusp and a pair of cusplets. However, by peeling back the dental membrane in each jaw the writer observed the transition of this series to typical broad, triangular, heavily-serrated, *amboinensis* teeth along each tooth row. The tooth row count of this specimen is 27/25, well in the range of *C. amboinensis*, and its tooth morphology, very short, bluntly rounded snout, short, triangular, non-tubular anterior nasal flaps, lack of an interdorsal ridge, anteriorly situated first dorsal fin with origin over or slightly anterior to the pectoral insertions, very small second dorsal fin with nearly straight posterior margin, deeply notched anal fin, and small eyes fit that species. The writer was able to directly compare the holotype of *Triaenodon obtusus* with Indian specimens of *Carcharhinus leucas* and *Glyphis gangeticus* and found it to be not identical to these species. Hence *Triaenodon obtusus* is removed from this genus and placed in synonymy of *Carcharhinus amboinensis*.

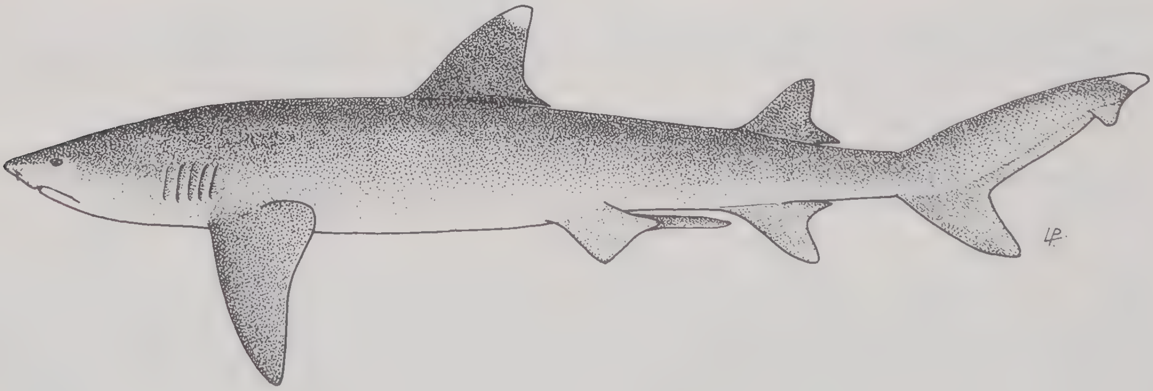
Triaenodon obesus (Rüppell, 1837)

CARCH Tria 1

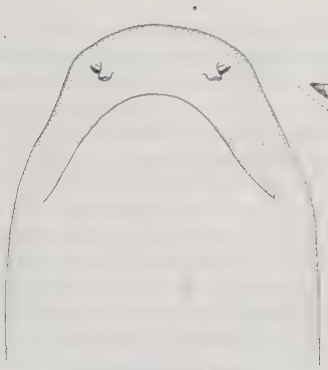
Carcharias obesus Rüppell, 1837, *Neue Wirbel.Faun.Abyssinien.Fische Rothen Meeres*, (11):64, pl. 18, fig. 2. Lectotype: Naturmuseums Senckenberg, SMF 3149, 310 mm stuffed specimen, designated by Klausewitz (1960:291). Type Locality: Djedda, Saudi Arabia, Red Sea.

Synonymy : *Triaenodon apicalis* Whitley, 1939 (see remarks, below).

FAO Names : En - Whitetip reef shark; Fr - Requin corail; Sp - Tiburón coralero ñato.



Field Marks : A small, fairly slender grey requiem shark with brilliant, extremely conspicuous white tips (not entire posterior margins) on its first dorsal fin and upper caudal lobe (white tip sometimes present on the second dorsal, ventral caudal lobe, and underside of the pectoral fins), lighter undersides shading gradually into darker dorsal coloration, an extremely short, broad snout, horizontally oval eyes with posterior notches, downslanted mouth and prominent brow ridges that give its face a sardonic, disgusted look, prominent expanded, tubular anterior nasal flaps, a large second dorsal fin that is still considerably smaller than the first dorsal, and small smooth-edged teeth with strong cusplets in both jaws.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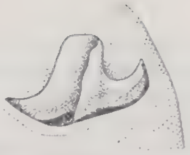
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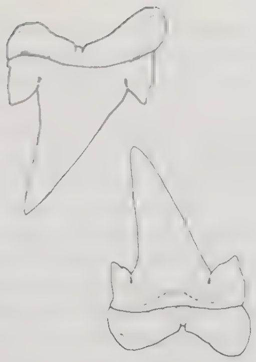
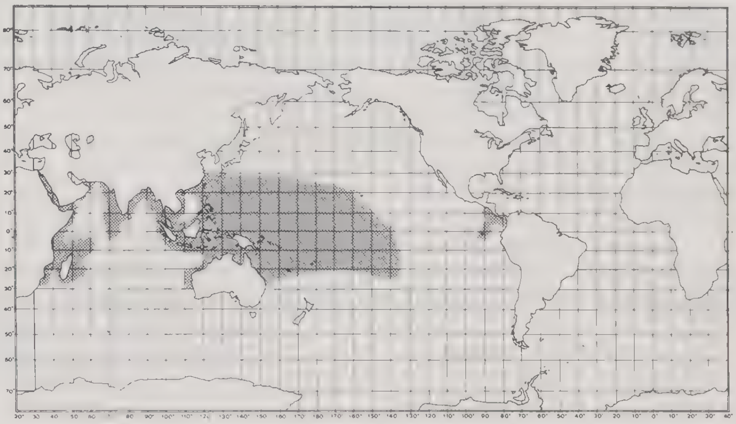

upper and lower tooth

Diagnostic Features : See genus.

Geographical Distribution : Wide-ranging in the Indo-Pacific. Indo-West and central Pacific: South Africa and Red Sea to Pakistan, India, Sri Lanka, Burma, Indonesia, Viet Nam, Taiwan Island, Riu Kiu Islands, The Philippines, Australia (Queensland, north and Western Australia), New Guinea; widespread in Polynesia, Melanesia and Micronesia northward to the Hawaiian Islands and southwest to the Pitcairn group (see Randall, 1977 for details of the range of this species in Oceania). Eastern Pacific: Cocos and Galapagos Islands, Panama to Costa Rica.



Habitat and Biology : A common tropical inshore shark of the continental shelves and island terraces, frequently found in shallow, clear water, on or near coral reefs; often at depths of 8 to 40 m but up to a metre or less or exceptionally down to 110 m or even 330 m; commonly occurring on or near the bottom, in crevices or caves in coral reefs, and in coral lagoons. It is often seen resting on the bottom, in caves and under ledges in coral and on sand. In Oceania, it is one of the commonest reef sharks, along with the blacktip reef shark, Carcharhinus melanopterus and the grey reef shark, C. amblyrhynchos. It does not frequent extremely shallow reef and sandy areas like the blacktip reef shark, nor does it range well above the substrate and near outer dropoffs like the grey reef shark.

This is a bottom-oriented shark that superficially resembles the sharks of the genus Triakis in its active, undulating swimming pattern, and like some of these triakids seldom comes to the surface and is readily capable of sitting motionless on the bottom for long periods. Tagging studies (including sonic tagging) indicate that these sharks have a diel and tidal activity pattern, being most active at night and at slack tides where strong currents occur. They aggregate in caves during daytime but are often more active during slack tides. Their usual routine may be interrupted by learned behaviour in areas where much spearfishing occurs, as they tend to come out of their caves when spearfishing starts, and search for speared prey. Apparently the sound of spearfishing activities, or even a boat dropping anchor, cues the sharks and arouses them.

Individual whitetip reef sharks return to the same caves in the day for long periods, but preferences for caves change periodically with given individuals, so that they vacate a given cave and rest in another after some time. These sharks have a narrow home range for their daily activities and can remain in a given small area for months or even years, but eventually may quit an area and wander for a time before fixating on a new area. Apparently these sharks are not territorial, but share their home range with other members of their species and other sharks without conflict. Distances travelled by given individuals have been from 0.3 to about 3 km in periods up to about a year, and an estimation of the sizes of home ranges of these sharks has been given as several square kilometres.

Data on growth in this species are limited, but from estimations by Randall (1977) the reef whitetip may take at least 5 years to reach maturity, and reach a maximum age of at least 25 years.

Viviparous, with 1 to 5 young per litter (commonly two or three). In French Polynesia, this shark apparently gives birth in autumn or winter, May to August, while at Enewetak Atoll they may give birth in July. Data from Randall (1977) from mature female sharks from Johnston Island and Enewetak Atoll suggests that this shark has a gestation period of at least 5 months, but this needs to be confirmed.

Unlike many carcharhinids, this shark is an inept pelagic predator, but is an efficient specialist in capturing bottom prey in crevices, holes and caves in coral heads and ledges. It apparently orients to olfactory and sonic cues but may have considerable difficulty finding cut baits. One or more whitetips may pursue a wounded, speared fish headfirst into a hole or crevice, and attempt to grab it. If they fail to immediately capture it they may rest with their bodies half out of the hole the prey is in, but sooner or later one will grab the prey. The shark then thrashes until it extracts or dismembers its victim. It feeds primarily on bony fishes, including eels (a moray was found in one), squirrelfishes, snappers, damselfishes, parrotfishes, surgeonfishes, triggerfishes, and goatfishes and octopi, but also spiny lobsters and crabs. One whitetip reef shark was found in the stomach of a giant grouper, and it is likely that other, larger carcharhinid sharks prey on it.

The whitetip reef shark often does not react to swimmers or divers unless approached, in which case it flees or keeps a distance between itself and the people involved. When spearfishing, other fish-collecting activity or deliberate baiting to lure sharks for photography is done by divers near the bottom where this shark occurs, it is readily attracted and seeks out potential food sources. Although whitetips may approach divers very closely under such conditions, they are rarely aggressive, and divers have been able to feed them by hand. On rare occasions, whitetips have bitten divers, but apparently in self-defence when molested, and especially when excited during spearfishing bouts. For example, Randall (1977) was attacked by one that he had speared and pursued. Other divers have had to repeatedly fend off excited and apparently attacking whitetips while contesting speared fishes with them. One spearfishing diver was bitten in the leg by a whitetip that had come up behind him, but was not greatly injured. Its small size, small teeth, and generally placid and unaggresive behaviour makes it far less dangerous than many other carcharhinids, but even this shark can be stimulated into attacking, like a domestic cat or dog. Randall (1977) regards the possibility of ciguatera poisoning from eating the meat of the whitetip as more of a danger than attack by it, although areas where whitetips are toxic are few and sporadic.

Size : Maximum said to be about 213 cm but adults are very rare over 160 cm; males maturing at about 104 to 105 cm and reaching 168 cm, females maturing at 105 to 109+ cm and reaching at least 158 cm; size at birth about 52 to 60 cm.

Interest to Fisheries : Details of fisheries involving this species are sketchy. It is apparently fished off Pakistan, India, Sri Lanka and Madagascar, and probably elsewhere where it occurs. It is fished with floating and fixed bottom gillnets and longlines, and its meat and liver utilized fresh for human consumption.

Literature : Beebe & Tee-Van (1941); Fowler (1941); Wheeler (1960); Fourmanoir (1961); Gohar & Mazhar (1964); Bass, D'Aubrey & Kistnasamy (1975b); Taniuchi (1975); Randall (1977); Johnson (1978); Compagno (1979).

Remarks : Randall (1977) presented a comprehensive survey of the life-history of this species, with a detailed review of its distribution.

The characters said by Whitley (1939) to separate his T. apicalis from the wide-ranging T. obesus apparently do not hold (Taniuchi, 1975; Bass, D'Aubrey & Kistnasamy, 1975b; Randall, 1977; Compagno, 1979), nor do eastern Pacific representatives of the species differ significantly from Indo-West Pacific sharks (Compagno, 1979).

9.8 FAMILY SPHYRNIDAE Gill, 1872

SPHYRN

Family Sphyrnidae Gill, 1872, Smithsonian Misc.Coll., (247):24.

Synonymy : Subfamily Zyganinae Swainson, 1838 (Family Squalidae); Family Zygaenidae Owen, 1846; Family Cestraciontoidae Gill, 1862 (not Subfamily Cestraciontini Bonaparte, 1838 equals Family Heterodontidae Gray, 1851).

FAO Names : En - Bonnethead sharks, Hammerhead sharks, Scoophead sharks; Fr - Requins marteau; Sp - Cornudas.

Field Marks : The hammer or mallet-shaped lateral expansions of the heads of these sharks are unique.

Diagnostic Features : Head with laterally expanded blades, shaped like a double-bitted axe or mallet in profile; eyes circular or nearly so; nictitating eyelids internal; spiracles absent; anterior nasal flaps short and triangular, not barbel-like; internarial width usually about 7 to 14 times the nostril width (but only 1.1 to 1.3 times it in Eusphyra, which has tremendously expanded nostrils); labial furrows vestigial or absent; teeth small to moderately large, more or less bladelike, with acute and narrow to moderately broad cusps, no lateral cusplets, and with basal ledges and grooves strong to absent; teeth weakly differentiated in upper and lower jaws; tooth rows 24 to 37/25 to 37. Precaudal pits present. First dorsal fin moderate-sized to very large but not keel-like, much shorter than caudal fin; first dorsal base ahead of pelvic bases, varying from equidistant between pectoral and pelvic bases to closer to pectoral bases; midpoint of first dorsal base always in front of pelvic origins; second dorsal fin much smaller than first; pectoral fins with radials extending into distal web of fins. Ventral caudal lobe strong, undulations or ripples present in dorsal caudal margin. Neurocranium without primary supraorbital crests, but with tips of preorbital and postorbital processes fused to form unique secondary supraorbital crests; vertebral centra with strong, wedge-shaped intermedial calcifications. Valvular intestine with a scroll valve. Colour light grey or brownish above, white below, no colour pattern. Development viviparous.

Habitat, Distribution and Biology : The hammerheads are a small but common family of wide-ranging warm-temperate and tropical sharks found in continental and insular waters on or adjacent to their shelves but with none being truely oceanic. Depths range from the surface, surfline and intertidal region down to at least 275 m depth. Hammerheads are very active swimmers, ranging from the surface to the bottom, and occur in all warm seas. Several species occur in schools, sometimes with hundreds of individuals. Some of the larger species seem to find fish baits on longlines quicker than other sharks, and expire more swiftly than most other species after being caught. The unique flattened and laterally expanded prebranchial head of hammerheads has been interpreted by some shark biologists and functional morphologists as a bowplane primarily serving to increase manouvering capabilities in these sharks, but sensory physiologists and shark behaviourists are more impressed by the increased sensory capacity afforded by their expanded heads, like the sensor plate of a metal detector. The more wide-spaced eyes may enhance binocular vision anteriorly, the expanded nasal capsules allow larger nasal organs and perhaps a more acute and more directional olfactory sense, and the increased head area allows more extensive lateral line canals and Ampullae of Lorenzini and possibly more capable pressure and electromagnetic senses. In the genus Sphyrna the sequentially increased lateral expansion of the head among species may indicate enhanced manouverability as well as sensory enhancement in the more broad-headed species; however, head expansion is carried beyond what seems optimal for increasing manouverability in the bizarre winghead shark (Eusphyra blochii) but certainly may indicate a more capable sensorium in this shark. Hammerheads are versatile feeders that take a wide variety of bony fishes, elasmobranchs, cephalopods, crustaceans, and other prey; some habitually feed on other elasmobranchs, and one species (S. tiburo) has enlarged, almost Heterodontus-like posterior teeth as an adaptation to crushing invertebrate prey. Some of the larger species have been involved in attacks on people, but recent studies on a few species of these sharks show that they are not particularly aggressive in unbaited situations.

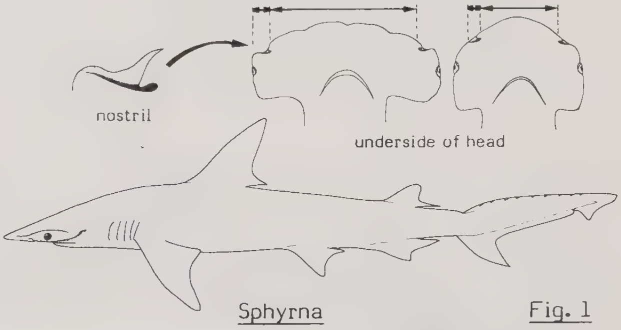
Interest to Fisheries : The larger species of Sphyrna are important elements of tropical inshore and offshore fisheries. The small species of Sphyrna and the small Eusphyra blochii figure in local fisheries where they occur.

Remarks : The present classification of the family follows Gilbert (1967, 1967a) and Compagno (1979).

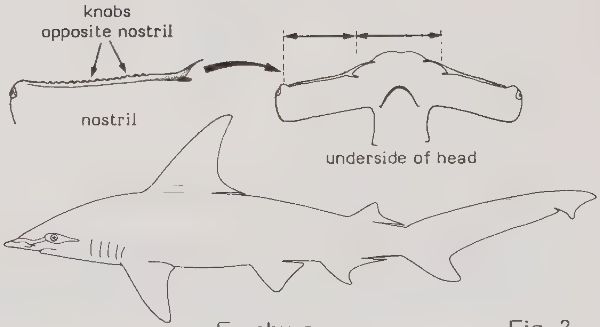
Key to Genera :

1a. Lateral blades of head anteroposteriorly broad, not winglike. Nostrils short, their widths 7 to 14 times in internarial width and less than half of mouth width. No knobs along anterior margin of head (Fig. 1) .... **Sphyrna**

1b. Lateral blades of head very narrow and winglike. Nostrils greatly enlarged, their widths 0.8 to 0.9 times in the internarial width and nearly twice the mouth width. Knobs present along anterior margin of head, opposite nostrils (Fig. 2) .... **Eusphyra**



Sphyrna Fig. 1



Eusphyra Fig. 2

Eusphyra Gill, 1862

SPHYRN Eusp

Genus : *Eusphyra* Gill, 1862, *Ann.Lyceum Nat.Hist.N.Y.*, 7(32):403, 412.

Type Species : "*Eusphyra blochii* Gill, 1862", by original designation, = "*z. nob. Blochii*" Cuvier, 1817 and *Zygaena blochii* Valenciennes, 1822.

Synonymy : None.

Diagnostic Features : Head wing- or arrow-shaped in dorsoventral view and very broad, width across head about 40 to 50% of total length; lateral blades of head very narrow and winglike; nostrils greatly enlarged, their widths 0.8 to 0.9 times in internarial width and nearly twice mouth width; bumps present along anterior margin of head opposite nostrils. Upper precaudal pit longitudinal and not crescentic.

Remarks : For the taxonomic history of this genus, and the rationalle for recognizing it, see Compagno (1979). Bigelow & Schroeder (1948) revived this genus, but it has met with mixed acceptance. Bigelow & Schroeder noted that it differed from *Sphyrna* by having its nostrils closer to the midline of the snout than the eyes rather than *vice-versa*, while Fraser-Brunner (1950) and Gilbert (1967, 1967a) distinguished it (as a subgenus) by the presence of "outer narial grooves" extending laterally nearly to the eyes. Compagno (1979) found that these grooves are not simple, dermal depressions like the prenarial grooves but are enormous lateral extensions of the nostrils.

Eusphyra blochii (Cuvier, 1817)

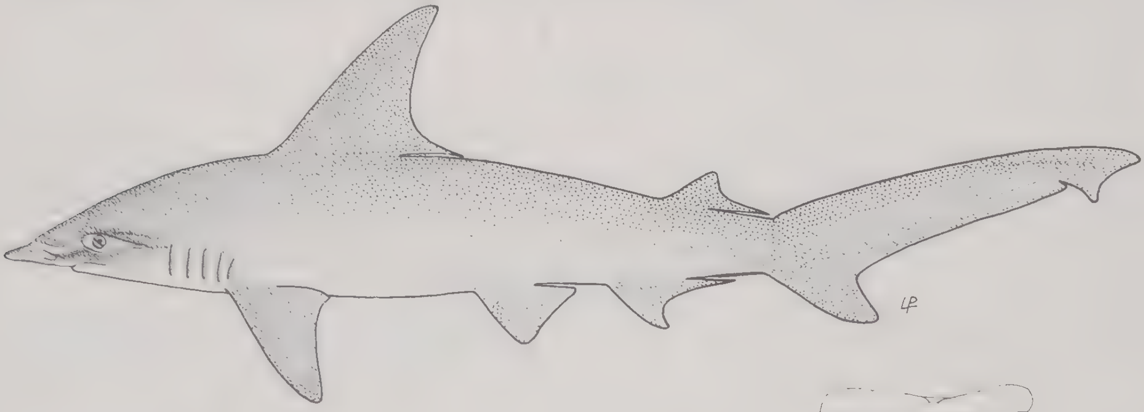
SPHYRN Eusp 1

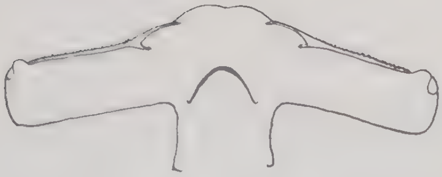
Zygaena nob. Blochii Cuvier, 1817, *Reg.Anim.*, 2:127, ftn. 3, also as *Zygaena Blochii* Valenciennes, 1822, *Mem.Mus.Hist.Nat.Paris*, 9:227, pl. 1, fig. 2. Based on the *Squalus zygaena* (not Linnaeus, 1758) of Bloch (1785, *Naturg.ausl.Fische*, 1, pl. 117). Holotype: None? Fowler (1941) thought the type locality to be India.

Synonymy : *Zygaena latycephala* van Hasselt, 1823; *Zygaena laticeps* Cantor, 1837.

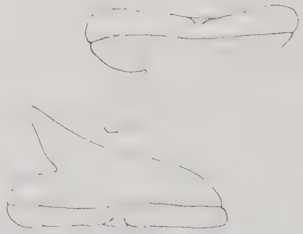
Other Scientific Names Recently in Use : *Sphyrna blochii* (Cuvier, 1817).

FAO Names : En - Winghead shark; Fr - Requin-marteau planeur; Sp - Cornuda planeadora.





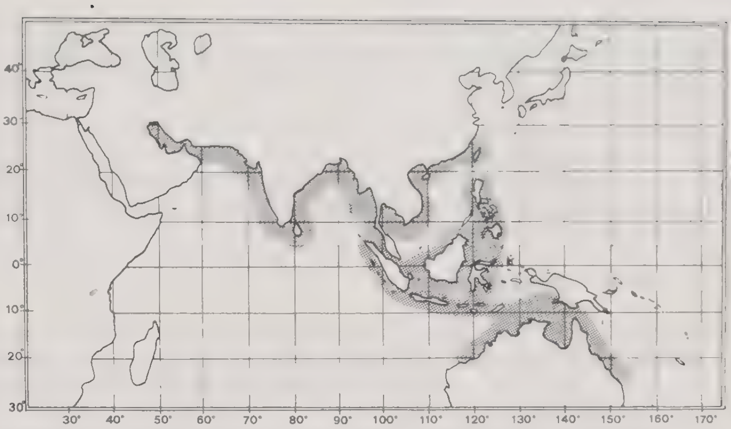
underside of head



upper and lower tooth

Field Marks : An unmistakable shark, with its immense, broad, wing-shaped head, nearly or quite half the shark's length.

Diagnostic Features : See genus.



Geographical Distribution : Indo-West Pacific: The "Gulf" between the Arabian Peninsula and Iran to Pakistan, India, Sri Lanka, Bangladesh, Burma, Malaysia, Thailand, Viet Nam, China, Taiwan Island, The Philippines, Indonesia, Australia (Queensland and Northern Territory).

Habitat and Biology : A rather small tropical shark of remarkable appearance, found in shallow water on the continental and insular shelves.

Viviparous, with a yolk-sac placenta; number of young 6 to 11 (most commonly 6). In Bombay waters, birth takes place just before the monsoon season, in April and May, mating apparently takes place during the monsoon, June through August, and females with small embryos appear in September and October; this suggests a gestation period of about 8 months, but this needs to be confirmed. Pregnant females are said to fight each other.

The diet of this small shark is not reported, but it probably consists of small fishes, cephalopods and crustaceans. An apparently harmless shark, not known to attack people.

The function of the vast lateral blades of the head of this shark are uncertain; they seem excessively hypertrophied for manouvering organs or bowplanes, but perhaps more important is their role in increasing the volume and surface area of some of the sense organs of the head, particularly the lateral line canals, Ampullae of Lorenzini, and olfactory organs, as well as providing an increased stereoscopic visual effect.

Size : Maximum possibly not exceeding 152 cm, males immature at 79 cm and adult at 132 cm, presumably maturing at a metre or less; pregnant females are 104 to 144 cm; size at birth 32 to 45 cm.

Interest to Fisheries : A common fisheries species in India, Pakistan, Malaysia and Thailand, and probably elsewhere in its range. It is caught with floating gillnets, probably fixed bottom gillnets, stake nets, seines, with floating and bottom longlines, and probably on hook-and-line. Its meat is utilized fresh for human consumption; livers yield a high-potency vitamin oil; and offal is probably processed into fishmeal.

Literature : Fowler (1941); Setna & Sarangdhar (1949, 1949b); Stead (1963); Gilbert (1967); Appukuttan (1978); Compagno (1979).

Remarks : Cuvier (1817), in a footnote to his account of Squalus zygaena Linnaeus, 1758 (placed in the new subgenus Zygaena Cuvier, 1817, but listed as S. zygaena), described this species as follows: "(3) Ajoutez l'espèce représentée par Bl.117, reconnaissable à ses narines placées bien plus près du milieu (z. nob. Blochii). Sa deuxième dorsale est aussi bien plus près de la caudale" (ftn 3, p. 127). Cuvier's citation of this species may not be a properly formed Linnaean binomial, but apparently he intended to show that the Squalus zygaena Bloch, 1785 was not conspecific with S. zygaena Linnaeus, 1758. "z. nob. Blochii" can be interpreted as Zygaena Blochii nobis (that is of Cuvier, 1817), as was done by Valenciennes (1822), who had an alcohol-preserved specimen of the species and described and illustrated it in detail.

Sphyrna Rafinesque, 1810

SPHYRN Sphyrn

Genus : Sphyrna Rafinesque, 1810, Indic.Ittiolog.Siciliana, Messina, 46, 60.

Type Species : Squalus zygaena Linnaeus, 1758, by subsequent designation of Jordan & Gilbert (1883:26).

Synonymy : Genus Sphyrnias Rafinesque, 1815; Subgenus Cestrorhinus Blainville, 1816 (Genus Squalus Linnaeus, 1758); Subgenus Zygaena Cuvier, 1817 (Genus Squalus Linnaeus, 1758); Genus Zygoena Risso, 1826; Genus Sphyrichthys Thienemann, 1828; Genus Platysqualus Swainson, 1839; Genus Zygaena Swainson, 1839; Genus Sphyra van der Hoeven, 1855; Genus Cestracion Gill, 1862 (junior homonym of Cestracion Oken, 1817); Genus Reniceps Gill, 1862.

Diagnostic Features : Head variably spade, mallet or axe-shaped in dorsoventral view and moderately broad, width across head about 17 to 33% of total length; lateral blades of head broad, not winglike; nostrils short, their widths 7 to 14 in internarial width and less than half mouth width; no bumps along anterior margin of head. Upper precaudal pit transverse and crescentic.

Remarks: Arrangement of the species follows Gilbert (1967, 1967a) and Compagno (1979), who recognize two subgenera: Platysqualus, for S. corona, S. media, S. tiburo, and S. tudes and Sphyrna, for S. couardi, S. lewini, S. mokarran, and S. zygaena. Gilbert (1967, 1967a) included Eusphyra as a subgenus of Sphyrna but Compagno (1979) ranked it as a genus.

According to Johnson (1978), there may be another species of large (to at least 3 m) hammerhead in French Polynesian waters, presumably belonging to the genus Sphyrna, subgenus Sphyrna, but which has a fairly narrow, relatively long mallet-shaped head rather like S. media. This has been seen several times by divers but specimens have not been collected yet.

Key to Species:

1a. Head shovel-shaped and narrow, its width 21% of total length or less (usually less). Anterior margin of head not notched. Posterior teeth expanded as broad, molariform crushers .... **S. tiburo**

1b. Head broader and more hammer- or axe-shaped, its width over 22% of total length. Anterior margin of head more or less notched, just medial to nostrils. Posterior teeth not expanded as molariform crushers

2a. Posterior margins of lateral blades of head usually more or less transverse. Free rear tip of first dorsal over or behind pelvic origins. Posterior margin of anal fin straight or concave, not deeply notched. Size smaller, adults less than 2 m

3a. Prenarial grooves present on anterior edge of head medial to nostrils. Head with a well-defined medial indentation and paired lateral indentations on its anterior edge. First dorsal fin more erect .... **S. tudes**

3b. Prenarial grooves hardly developed on anterior edge of head. Head with poorly defined medial and lateral indentations. First dorsal fin more falcate

4a. Snout longer, preoral length usually over 2/5 of head width. Mouth narrowly arched. Anal fin shallowly concave .... **S. corona**

4b. Snout shorter, preoral length usually less than 2/5 of head width. Mouth broadly arched. Anal fin more deeply concave .... **S. media**

2b. Posterior margins of lateral blades of head usually arching posterolaterally (except in adults of S. mokarran). Free rear tip of first dorsal well in front of pelvic origins. Posterior margin of anal fin usually deeply notched. Size larger, adults at least 3 m

5a. Anterior margin of head nearly straight in adults. Prenarial grooves absent or hardly developed. Teeth strongly serrated at all sizes. Pelvic fins high and falcate. First dorsal markedly falcate. Second dorsal fin high, with a short inner margin and deeply concave posterior margin .... **S. mokarran**

5b. Anterior margin of head moderately convex in adults, strongly so in young. Prenarial grooves well-developed. Teeth smooth-edged in young, weakly serrate in adults. Pelvic fins low and not falcate, with nearly straight posterior edges. First dorsal usually semifalcate. Second dorsal fin low, with a long inner margin and nearly straight posterior margin

6a. No median indentation on anterior margin of head. Free rear tip of second dorsal well ahead of upper caudal origin. Anal base about as large as second dorsal base .... **S. zygaena**

6b. A prominent median indentation on anterior margin of head. Free rear tip of second dorsal nearly reaching upper caudal origin. Anal base noticeably larger than that of second dorsal

7a. Lateral lobes of head narrower transversely and longer from front to back in adults. First dorsal origin over pectoral midbases. Pectoral fins plain, not dark-tipped .... **S. couardi**

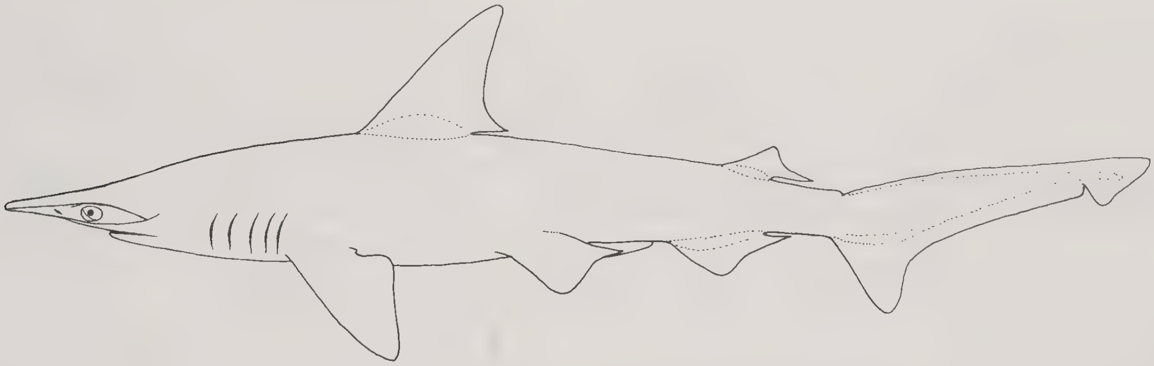
7b. Lateral lobes of head broader transversely and shorter from front to back in adults. First dorsal origin slightly behind pectoral insertions. Pectoral fins dark-tipped .... **S. lewini**

Sphyrna corona Springer, 1940

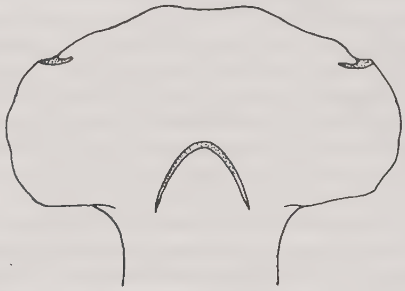
Sphyrna corona Springer, 1940, Stanford Ichthyol.Bull., 1(5):163, fig. 4. Holotype: SU-11882, 663 mm adult male. Type Locality: Panama, eastern Pacific.

Synonymy : None.

FAO Names : En - Scalloped bonnethead; Fr - Requin-marteau cornu; Sp - Cornuda coronada.



Field Marks : A small hammerhead with a moderately broad, anteriorly arched, mallet-shaped head with medial and lateral indentations on its anterior edge and transverse posterior margins, no prenarial grooves, snout rather long and about 2/5 of head width, small, strongly arched mouth, free rear tip of first dorsal fin over pelvic insertions, posterior margin of anal fin nearly straight.



underside of head

Diagnostic Features : Expanded prebranchial head mallet-shaped and moderately wide but longitudinally elongated, its width 24 to 29% of total length (mostly above 25%); distance from tip of snout to rear insertions of posterior margins of expanded blades over half of head width; anterior margin of head broadly arched with shallow lateral and medial indentations; posterior margins of head moderately wide, transverse, and broader than mouth width; prenarial grooves hardly developed anteromedial to nostrils; preoral snout about 2/5 of head width; rear ends of eyes well anterior to upper symphysis of mouth; mouth rather narrowly arched; anterior teeth with long slender cusps, not serrated, posterior teeth mostly cuspidate and not molariform. First dorsal moderately falcate, its origin just behind pectoral insertions, its free rear tip about opposite or behind pelvic origins; second dorsal fin moderately high, slightly lower than anal, with a weakly concave posterior margin; its inner margin moderately long, less than twice fin height, and ending well ahead of upper caudal origin; pelvic fins not falcate, with straight or slightly concave posterior margins; anal fin larger than second dorsal fin and rather long, base 8.2 to 9.2% of total length; its origin in front of second dorsal origin, its posterior margin shallowly concave to nearly straight. Total vertebral centra 135 to 140. A small hammerhead, maximum size less than 1 m. Colour grey above, white below, no prominent fin markings.

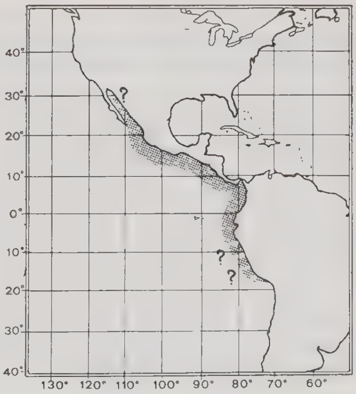
Geographical Distribution : Eastern Pacific: ? Gulf of California, and southern Mexico to Peru.

Habitat and Biology : Almost nothing is known of the biology of this small uncommon tropical hammerhead, which lives on the continental shelf, presumably inshore. Viviparous, with a yolk-sac placenta; number of young per litter 2 ?

Size : Maximum about 92 cm; adolescent male 51 cm, adult male, 67 cm; size at birth at or above 23 cm. Probably the smallest species of hammerhead.

Interest to Fisheries : Probably taken in local inshore fisheries where it occurs, but details are lacking.

Literature : Springer (1940); Beebe & Tee-Van (1941); Kato, Springer & Wagner (1967); Gilbert (1967); Chirichigno (1980).



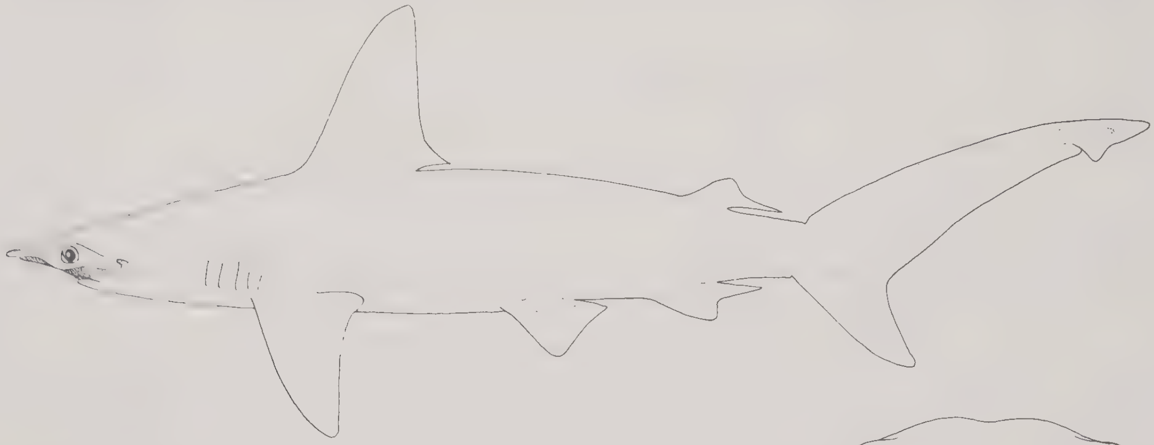
Sphyrna couardi Cadenat, 1950

SPHYRN Sphyrn 6

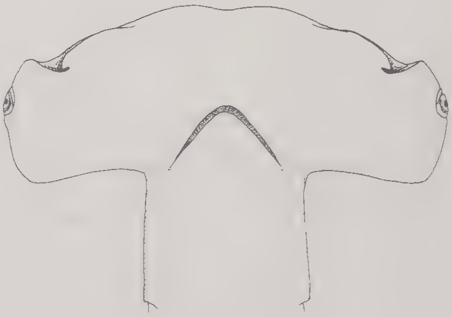
Sphyrna couardi Cadenat, 1950, *Bull.Inst.Fr.Afr.Noire*, (3):99. Holotype: In Museum National d'Histoire Naturelle, Paris? Type Locality: Senegal.

Synonymy : None.

FAO Names : En - Whitefin hammerhead; Fr - Requin-marteau aile blanche; Sp - Cornuda aliblanca.



Field Marks : A large hammerhead with a moderately broad, fairly narrow-bladed head, anterior margin of head very broadly arched in adults and with a prominent median indentation, teeth with moderately broad cusps and smooth edges, moderately falcate first dorsal fin with origin over pectoral midbases and free rear tip in front of pelvic origins, low second dorsal fin with weakly concave posterior margin, long posterior margin about twice fin height, and free rear tip nearly or quite reaching upper caudal origin, non-falcate pelvic fins, a deeply notched posterior anal margin, and plain pectoral fins.



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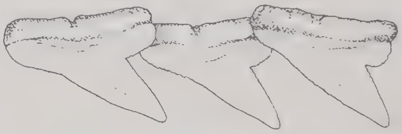


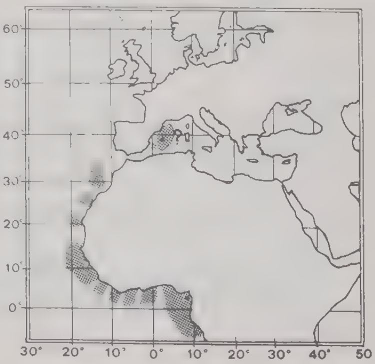
upper teeth

Diagnostic Features : Expanded prebranchial head hammer- or axe-shaped and moderately wide but longitudinally moderately short, its width 21 to 25% of total length; distance from tip of snout to rear insertions of posterior margins of expanded blades half to slightly less than half of head width; anterior margin of head broadly arched with prominent medial and lateral indentations; posterior margins of head of moderate width, angled posterolaterally, and about equal or less than mouth width; well-developed prenarial grooves present anteromedial to nostrils; preoral snout between 1/5 to 1/3 of head width; rear ends of eyes about opposite to upper symphysis of mouth; mouth rather broadly arched; anterior teeth with moderately long stout cusps and smooth edges, posterior teeth mostly cuspidate and not keeled and molariform. First dorsal somewhat falcate, its origin over rear ends of pectoral bases ahead of their insertions, its free rear tip well anterior to pelvic origins; second dorsal fin low, somewhat less than anal height, with a slightly concave posterior margin; its inner margin long, about twice the fin height, and ending almost opposite upper caudal origin; pelvic fins not falcate, with straight or slightly concave posterior margins; anal fin larger than second dorsal fin and rather long, base 4.5 to 5.6% of total length, its origin well ahead of second dorsal origin, its posterior margin deeply notched. Vertebral counts unknown. A large hammerhead, to 3 m. Colour blue-grey or grey-brown above, white below, fins unmarked.

Geographical Distribution : Eastern North Atlantic: Senegal, Ivory Coast, Guinea, Gabon, and Congo; possibly Mediterranean Sea.

Habitat and Biology : A little-known and uncommon coastal-pelagic shark of tropical West Africa. Viviparous, with a yolk-sac placenta; number of young 24 to 28. Mainly eats fishes, especially benthic bony fishes such as eels and flatfish, also benthic and epibenthic cephalopods. Not known to attack people.

Size : Maximum said to be about 300 cm; adult males 141 to 184 cm; adult (gravid) females from 230 to 235 cm; size at birth about or above 30 to 32 cm (full-term fetuses).



Interest to Fisheries : Taken in West African shark fisheries, but details are lacking.

Literature : Cadenat (1950); Gilbert (1967); Compagno (1979, 1981); Cadenat & Blache (1981).

Remarks : According to Cadenat & Blache (1981), one of the syntypes of *S. tudes* Valenciennes, 1822, MNHN 1049 from Nice, France (Mediterranean Sea), and the lectotype of that species as designated by Gilbert (1967), is actually based on a fetus of the present species (see remarks under *S. tudes*), which, apart from causing further nomenclatorial confusion, would also extend the range of this species into the Mediterranean.

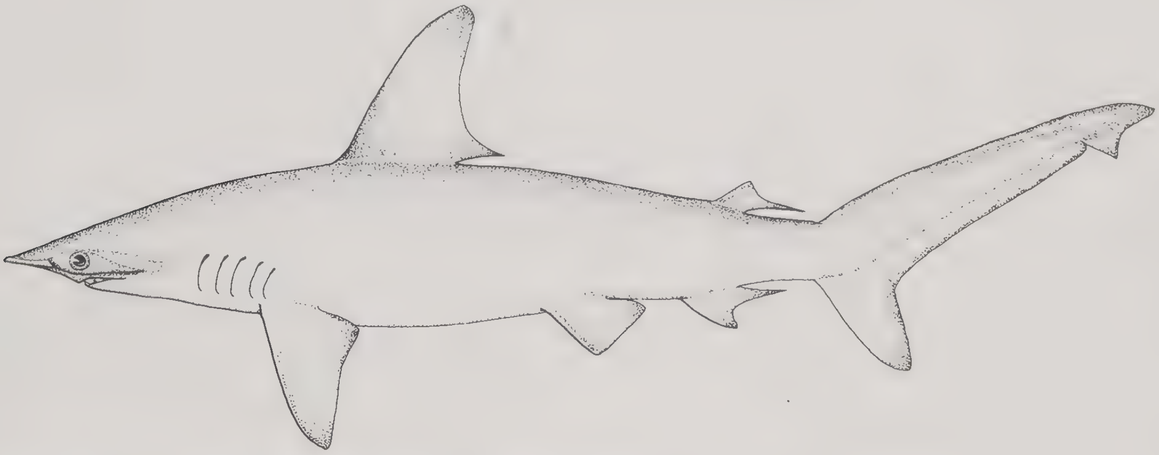
Sphyrna lewini (Griffith & Smith, 1834)

SPHYRN Sphyrn 1

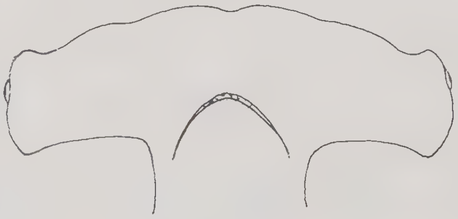
Zygaena lewini Griffith & Smith, *in* Cuvier, Griffith & Smith, 1834, *Anim.Kingd.*, 10:640, pl. 50. Holotype: Unknown. Type Locality: South coast of New Holland (Australia).

Synonymy : *Zygaena malleus* Valenciennes, 1822 (in part); ? *Zygaena indica* van Hasselt, 1823; *Cestracion leeuwenii* Day, 1865; *Zygaena erythraea* Hemprich & Ehrenberg, 1899; *Cestracion oceanica* Garman, 1913; *Sphyrna diplana* Springer, 1941.

FAO Names : En - Scalloped hammerhead; Fr - Requin-marteau halicorne; Sp - Cornuda común.

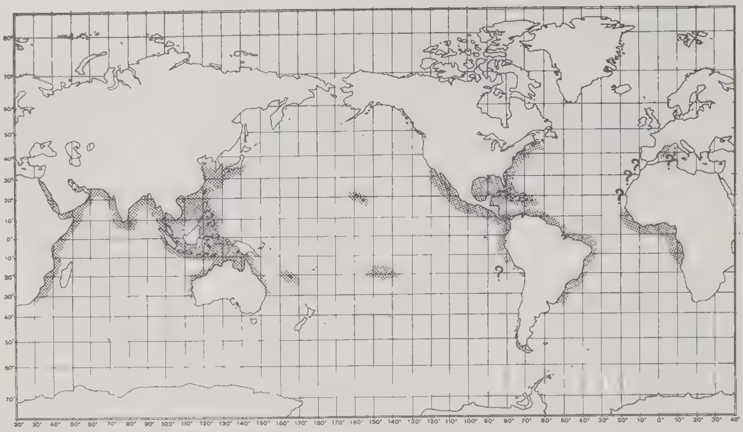


Field Marks : A large hammerhead with a broad, narrow-bladed head, anterior margin of head very broadly arched in adults and with a prominent median indentation, teeth with moderately broad cusps and smooth to weakly serrated edges, moderately falcate first dorsal fin with origin over or behind pectoral insertions and free rear tip in front of pelvic origins, low second dorsal fin with weakly concave posterior margin, long posterior margin about twice fin height, and free rear tip nearly or quite reaching upper caudal origin, non-falcate pelvic fins, a deeply notched posterior anal margin, and dusky or black-tipped pectoral fins.



underside of head

Diagnostic Features : Expanded prebranchial head hammer- or axe-shaped and very wide but longitudinally short, its width 24 to 30% of total length (mostly above 26%); distance from tip of snout to rear insertions of posterior margins of expanded blades less than half of head width; anterior margin of head very broadly arched, with prominent medial and lateral indentations; posterior margins of head wide, angled posterolaterally and generally broader than mouth width; well-developed prenarial grooves present anteromedial to nostrils; preoral snout about 1/5 to 1/3 of head width; rear ends of eyes slightly anterior to upper symphysis of mouth; mouth rather broadly arched; anterior teeth with moderately long, stout to slender cusps, smooth or weakly serrated, posterior teeth mostly cuspidate and not keeled and molariform. First dorsal moderately falcate, its origin above or slightly behind pectoral insertions, its free rear tip well anterior to pelvic origins; second dorsal fin low, less than anal height, with a shallow concave posterior margin; its inner margin long, about twice the fin height, and ending almost opposite upper caudal origin; pelvic fins not falcate, with straight or slightly concave posterior margins; anal fin larger than second dorsal fin and rather long, base 4.3 to 6.4% of total length; its origin well ahead of second dorsal origin, its posterior margin shallowly concave to nearly straight. Total vertebral centra 174 to 209. A large hammerhead, to over 3 m. Colour grey-brown above, white below, with dusky to black pectoral fin tips.



Geographical Distribution : Essentially circumglobal in coastal warm temperate and tropical seas. Western Atlantic: New Jersey to Brazil, including Gulf of Mexico and Caribbean. Eastern Atlantic from ? Mediterranean and Senegal to Zaire. Indo-West Pacific: South Africa and Red Sea to Pakistan, India, Burma, Thailand, Indonesia, China (including Taiwan Island), Japan, The Philippines, Australia (Queensland, Western Australia), New Caledonia. Central Pacific: Hawaii and Tahiti. Eastern Pacific: Southern California and Gulf of California to Panama, Ecuador and ? northern Peru.

Habitat and Biology : Probably the most abundant hammerhead, a coastal-pelagic, semioceanic warm-temperate and tropical species occurring over continental and insular shelves and in deep water adjacent to them, often approaching close inshore and entering enclosed bays and estuaries. Ranges from the intertidal and surface down to at least 275 m depth. Young sharks primarily occur close inshore. Forms large true schools at different stages of its life-history, though solitary individuals of both young and adults also occur.

This species is apparently highly mobile and in part migratory, and forms huge schools of small migrating individuals that move poleward in the summer in certain areas such as off Natal, South Africa. Elsewhere, as in the East China Sea, it may not migrate and is thought to form large resident populations. Adults males and females may segregate during certain phases of their life-cycle. Off southern Baja California, in the Gulf of California, polarized schools of scalloped hammerheads of mixed sexes with females predominating and sizes from immatures of slightly less than a metre to adults over 3 m have been intensely observed underwater by A. Peter Klimley and Donald R. Nelson. These congregate offshore over seamounts and near islands, and show a considerable range of behaviours including lateral tilting of the body (possibly to enhance the shark's view of divers when approached from above and behind them); accelerated swimming variants with headshaking, thrusting the midsection while swimming rightside up or upside down, and corkscrew swimming with rotation around their longitudinal axes; hitting other hammerheads with their snouts; jaw opening; and clasper flexion. Some of these displays may involve aggression or courtship. Many females bear apparent courtship scars, but a smaller proportion of males have them too. The function of these schools is uncertain: reproduction is thought unlikely because of the presence of juveniles in the schools; defence unlikely because of the absence of possible predators on the hammerheads; and grouping for attaining a swimming advantage in the strong currents that are common in these places is also unlikely because the sharks school when currents are absent. Feeding advantages may occur for the sharks to cluster near food resources or even for social feeding, but so far this is hypothetical because the sharks have never been seen to feed in the daytime when observations can be made, though they may do so at night. Sharks have been tracked and may wander off from the schooling area.

Viviparous, with a yolk-sac placenta; number of young in a litter 15 to 31. Off Hawaii, adults move inshore in Kaneohe Bay, Oahu to drop young and mate. The smallest young are found close inshore in the bay but these move into deeper water as they grow, to eventually depart for open water.

The scalloped hammerhead takes a wide variety of fish prey, but also invertebrates (especially cephalopods). Food items include sardines and herring, anchovies, ten-pounders (Elopidae), conger eels, milkfish, sea catfish, silversides, halfbeaks, mullet, lizardfish, barracuda, bluefish, spanish mackeral, jacks, porgies, mojarras, cardinal fishes, goatfish, grunts, damselfishes, parrotfishes, wrasses, butterfly fishes, surgeonfish, gobies, flatfish, sharpnose sharks (Rhizoprionodon), blacktip reef sharks, angelsharks, stingrays, squid, octopi, cuttlefishes, sea snails, shrimp, mantis shrimp, crabs, lobsters and isopods.

The scalloped hammerhead is probably dangerous to people but this is uncertain because until recently large hammerheads, particularly this species and S. zygaena, have been regularly confused with one another, and so several unprovoked and provoked attacks on swimmers and divers as well as a few boat attacks can only be attributed to 'hammerheads'. Under baited conditions these hammerheads have made close approaches to divers but quickly lost interest and departed when they apparently determined that the divers were not the source of the food odour. In ongoing studies on the social behaviour of these sharks off seamounts in the Gulf of California A. Peter Klimley and Donald R. Nelson (pers. comm.) have found large schools of adult scalloped hammerheads to be rather timid and very difficult to approach when they used SCUBA, so that much of their work must be done by free-diving on the sharks to measure, sex, tag, track with sonic tags, photographs, and record their activities. These sharks are probably less dangerous than the smaller but more aggressive grey reef shark (Carcharhinus amblyrhynchos), and much less than the bull, tiger and great white sharks.

Size : Maximum about 370 to 420 cm, males maturing at 140 to 165 cm and reching at least 295 cm, females maturing at about 212 cm and reaching at least 309 cm; size at birth 42 to 55 cm.

Interest to Fisheries : This is probably the commonest hammerhead in the tropics and is readily available in abundance to ishore artisanal and small commercial fisheries as well as offshore operations; it is caught with pelagic longlines, fixed bottom longlines, fixed bottom nets, and even bottom and pelagic trawls; the young are easily caught on light longline gear. The meat is utilized fresh, fresh-frozen, dried salted and smoked for human consumption; the fins are used to prepare shark-fin soup base; the hides are prepared into leather; the oil used for vitamins; and carcasses for fishmeal.

Literature : Bigelow & Schroeder (1948); Cadenat (1957); Garrick & Schultz (1963); Gilbert (1967); Carvallo (1967); Kato, Springer & Wagner (1967); Clarke (1971); Taniuchi (1974); Bass, D'Aubrey & Kistnasamy (1975a); Compagno & Vergara (1978); Johnson (1978); Compagno (1979, 1982); Klimley (1981); Klimley & Nelson (1981); Nelson (1981); Cadenat & Blache (1981).

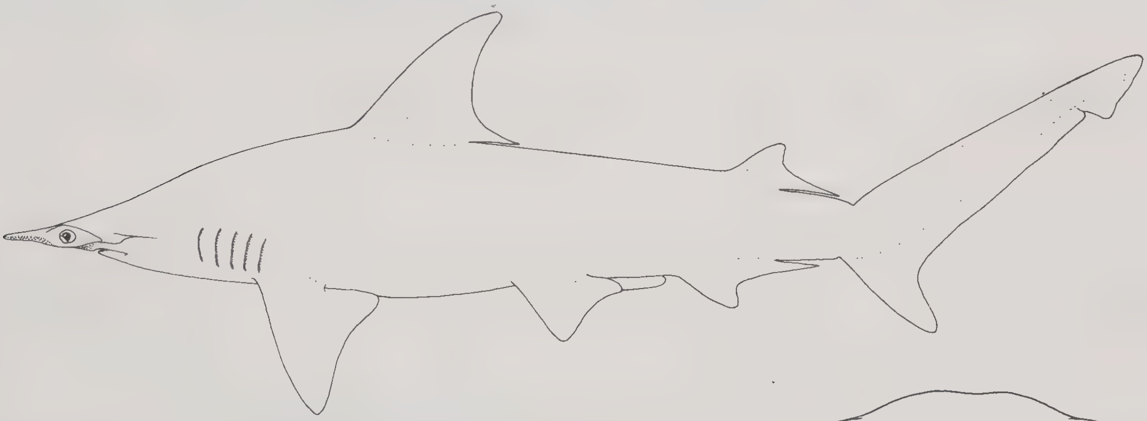
Sphyrna media Springer, 1940

SPHYRN Sphyrn 7

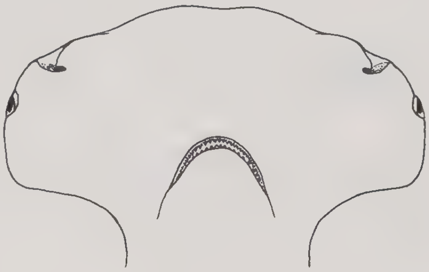
Sphyrna media Springer, 1940, *Stanford Ichthyol.Bull.*, 1(5):162, fig. 3. Holotype: Stanford University Natural History Museum collection, SU-11583, 900 mm adult male. Type Locality: Mazatlan, Sinaloa, Mexico.

Synonymy : *Sphyrna nana* Sadowsky, 1965.

FAO Names : En - Scoophead; Fr - Requin-marteau écope; Sp - Cornuda cuchara.



Field Marks : A small hammerhead with a moderately broad, anteriorly arched, mallet-shaped head with weak medial and lateral indentations on its anterior edge and transverse posterior margins, no prenarial grooves, snout rather short and about 1/3 of head width, moderately large, broadly arched mouth, free rear tip of first dorsal fin over pelvic insertions, posterior margin of anal fin nearly straight.



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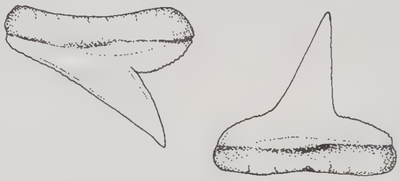
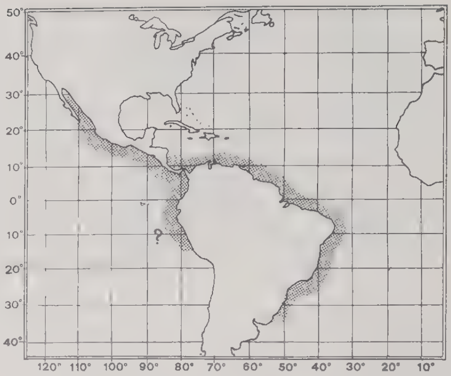


upper and lower tooth

Diagnostic Features : Expanded prebranchial head mallet-shaped and moderately wide but longitudinally expanded also, its width 22 to 33% of total length (mostly above 23%); distance from tip of snout to rear insertions of posterior margins of expanded blades half the width of head or more; anterior margin of head broadly arched, with weak medial and lateral indentations; posterior margins of head narrow, angled transversely, and as broad or somewhat narrower than mouth width; prenarial grooves absent or hardly developed; preoral snout about 1/3 to 2/5 of head width; rear ends of eyes somewhat anterior to upper symphysis of mouth; mouth rather broadly arched; anterior teeth with long slender, smooth-edged cusps, posterior teeth mostly cuspidate and not keeled and molariform. First dorsal moderately falcate, its origin over inner margins of pectoral fins and near their insertions, its free rear tip over pelvic origins; second dorsal fin moderately high, equal to or less than anal height, with a straight to moderately concave posterior margin; its inner margin short, less than twice fin height, and ending well in front to slightly in front of upper caudal origin; pelvic fins not falcate, with straight or slightly concave posterior margins; anal fin larger than second dorsal fin and rather long, base 7.2 to 9% of total length; its origin well ahead of second dorsal origin, its posterior margin shallowly to moderately concave. Total vertebral centra 101 to 196. A small hammerhead, to 1.5 m. Colour grey-brown above, light below, fins unmarked.



Geographical Distribution : Western Atlantic: Panama to southern Brazil. Eastern Pacific: Gulf of California to Ecuador and probably northern Peru.

Habitat and Biology : A little-known, inshore tropical hammerhead of the American continental shelves.

Size : Maximum about 150 cm, adult male 90 cm, adult females 100 to 133 cm, adolescent female 83 cm; size at birth 34 cm or less.

Interest to Fisheries : Taken with bottom longlines and utilized fresh for human consumption and for fishmeal.

Literature : Springer (1940); Beebe & Tee-Van (1941); Sadowsky (1965, 1967); Gilbert (1967); Kato, Springer & Wagner (1967); Chirichigno (1980).

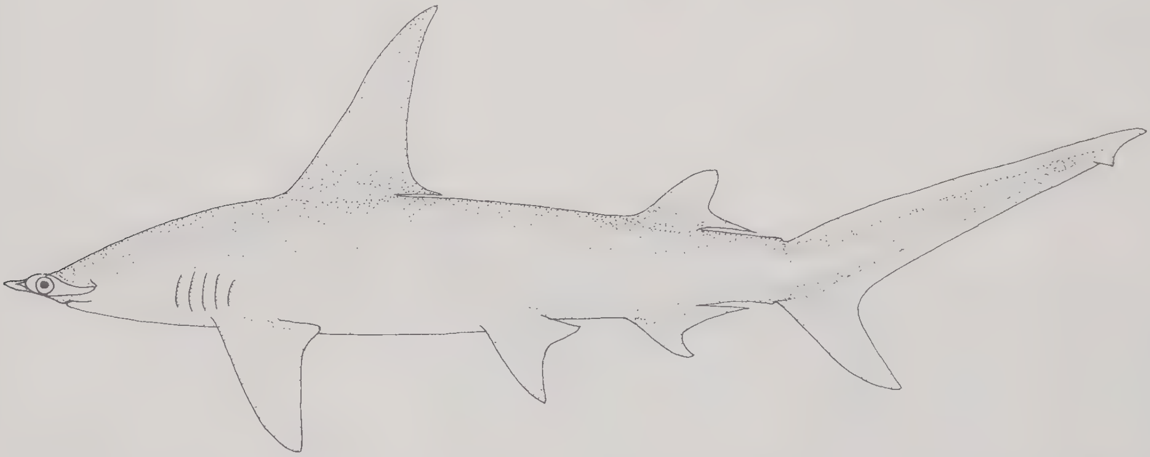
Sphyrna mokarran (Rüppell, 1837)

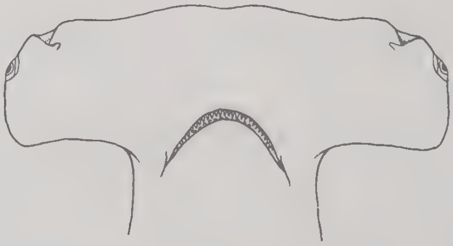
SPHYRN Sphyrn 3

Zygaena mokarran Rüppell, 1837, Neue Wirbel.faun.Abyssinien, Fische rothen Meeres, (11):64, pl. 18, fig. 1. Holotype: According to Klausewitz (1960:293) there is a lectotype, Naturmuseums Senckenberg SMB 3590, 2515 mm stuffed adult or adolescent male. Type Locality: Massaua, Red Sea.

Synonymy : Zygaena dissimilis Murray, 1887; Sphyrna ligo Fraser-Brunner, 1950.

FAO Names : En - Great hammerhead; Fr - Grand requin-marteau; Sp - Cornuda gigante.



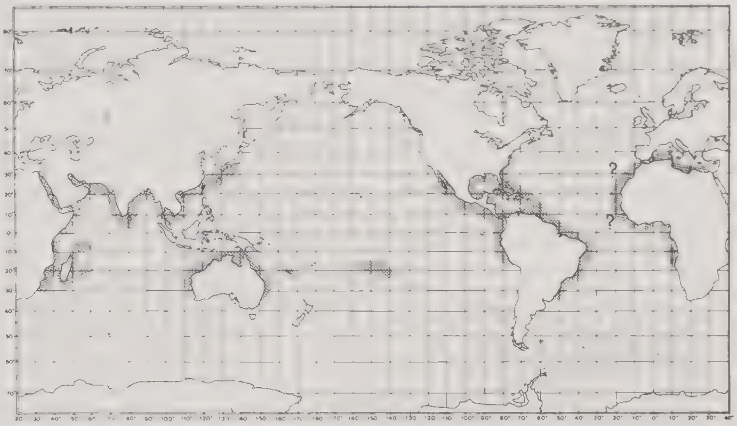


underside of head

Field Marks : An easily recognized large hammerhead with anterior margin of head nearly straight in adults and with a median indentation, strongly serrate teeth, strongly falcate first dorsal fin with rear tip in front of pelvic origins, high second dorsal fin with strongly concave posterior margin and short inner margin, falcate pelvic fins, and a deeply notched posterior anal margin.

Diagnostic Features : Expanded prebranchial head hammer- or axe-shaped and very wide but longitudinally short, its width 23 to 27% of total length (mostly above 23%); distance from tip of snout to rear insertions of posterior margins of expanded blades less than half of head width; anterior margin of head very broadly arched in young but nearly straight in adults, with prominent medial and lateral indentations; posterior margins of head long, angled posterolaterally in young but transverse in adults, and about as broad as mouth width; prenarial grooves absent or hardly developed; preoral snout less than 1/3 of head width; rear ends of eyes anterior to upper symphysis of mouth; mouth rather broadly arched; anterior teeth with moderately long stout cusps, strongly serrated edges, posterior teeth mostly cuspidate and not keeled and molariform. First dorsal strongly falcate, its origin over or slightly behind pectoral insertions, its free rear tip well anterior to pelvic origins; second dorsal fin high, about equal to anal height, with a strongly concave posterior margin; its inner margin short, about equal to fin height, and ending well in front of upper caudal origin; pelvic fins strongly falcate, with strongly concave posterior margins; anal fin about as large as or larger than second dorsal fin and moderately long, its base 5.6 to 7.3% of total length, its origin well ahead of second dorsal origin, its posterior margin deeply notched. Total vertebral centra 197 to 212. A large to gigantic hammerhead to 3 to 5.5+ m. Colour grey-brown above, light below, without fin markings.

Geographical Distribution : Circumtropical. Western Atlantic: North Carolina to Brazil, including Gulf of Mexico and Caribbean. Eastern North Atlantic: Morocco, Senegal, ?Canary Island, ?Gambia, ? Guinea; Mediterranean. Indo-West Pacific: South Africa and Red Sea to India, Thailand, China, Taiwan Island, Riu Kyu Islands, Australia (Northern Territory, Queensland, New South Wales), New Caledonia, French Polynesia. Eastern Pacific: Southern Baja California and Gulf of California to Panama, Ecuador and northern Peru.



Habitat and Biology : A coastal-pelagic and semi-oceanic tropical hammerhead occurring close inshore and well offshore, over the continental shelves, island terraces, and in passes and lagoons of coral atolls, as well as over deep water near land; depths range from near the surface and in water about a metre deep to over 80 m. The great hammerhead often favours continental and insular coral reefs. It apparently is nomadic and migratory, with some populations moving poleward in the summer, as off Florida and in the South China Sea.

Viviparous, with a yolk-sac placenta; number of young 13 to 42. Sex ratios of fetuses are approximately 1:1. The gestation period may be at least 7 months. Birth occurs in late spring or summer in the Northern Hemisphere.

The great hammerhead takes a variety of prey, but seems especially to favour stingrays and other batoids, groupers and sea catfishes. Its diet includes tarpon, sardines, sea catfishes, toadfish, porgies, grunts, jacks, croakers, groupers and other serranids, tongue-soles, boxfishes, porcupine fishes, smooth-hounds (Mustelus) and other sharks, guitarfish, skates, stingrays, cownosed rays, crabs and squid. This species seems not to be bothered by the poisonous spines of its stingray and catfish prey, and is sometimes found with stings imbedded in its buccal cavity (one had about fifty stings in its mouth, throat and tongue). This and other large hammerheads were the first to reach newly baited sharklines in the Florida shark fishery, indicating a particularly keen olfactory sense.

This species is thought to be dangerous to people, though few if any attacks can be definitely attributed to it because of the apparent difficulty of distinguishing the large hammerhead species involved in attacks. In unbaited situations these hammerheads have approached divers but behaved unaggressively. The size and rather broad food spectrum of the great hammerhead, plus the considerable number of attacks attributed to hammerheads in general, make it a shark to be treated with respect and caution.

Size : Maximum 550 to 610+ cm , but most adults of either sex not above 366 cm; a small percentage of the population (mainly or entirely females?) attain a size much greater than the adult average; males maturing at about 234 to 269 cm and reaching at least 341 cm; females maturing at about 250 to 300 cm and reaching 482 to 549+ cm; size at birth 50 to 70 cm.

Interest to Fisheries : Although less abundant than S. lewini, this species is regularly caught in the tropics, with longlines, fixed bottom nets, hook-and-line, and possibly with pelagic and bottom trawls. This species is utilized for its meat, fresh, fresh-frozen, dried salted and smoked for human consumption; for hides, processed into leather; for fins used for shark-fin soup base; for liver oil, processed for vitamins; and carcasses for fishmeal.

Literature : Bigelow & Schroeder (1948); Cadenat (1957); Springer (1960, 1963); Fourmanoir (1961); Garrick & Schultz (1963); Randall (1963); Clark & von Schmidt (1965); Gilbert (1967, a); Carvallo (1967); Sadowsky (1971); Taniuchi (1974); Bass, D'Aubrey & Kistnasamy (1975b); Johnson (1978); Compagno (1981); Cadenat & Blache (1981).

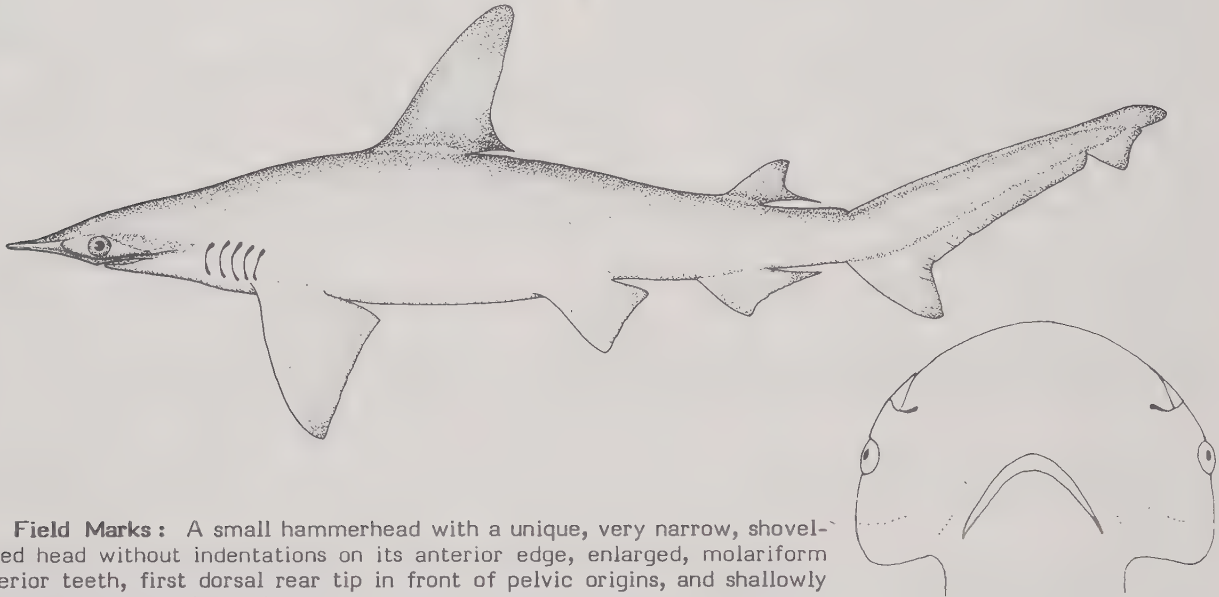
Sphyrna tiburo (Linnaeus, 1758)

SPHYRN Sphyrn 2

Squalus tiburo Linnaeus, 1758, Syst.Nat., 10, 1:234. Holotype: None. Type Locality: "Habitat in America".

Synonymy : Sphyrna vespertina Springer, 1940.

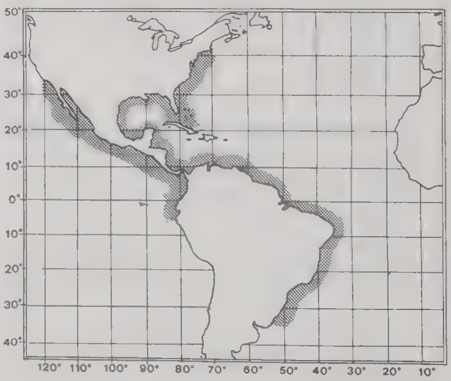
FAO Names : En - Bonnethead; Fr - Requin-marteau tiburo; Sp - Cornuda tiburo.



Field Marks : A small hammerhead with a unique, very narrow, shovel-shaped head without indentations on its anterior edge, enlarged, molariform posterior teeth, first dorsal rear tip in front of pelvic origins, and shallowly concave posterior anal margin.

Diagnostic Features : Expanded prebranchial head shovel-shaped and rather narrow but longitudinally elongated, its width 18 to 25% of total length (mostly below 21%); distance from tip of snout to rear insertions of posterior margins of expanded blades over half of head width; anterior margin of head broadly arched or somewhat angular, without indentations; posterior margins of head short, transverse, or angled posterolaterally, and generally narrower than mouth width; prenarial grooves not present anteromedial to nostrils; preoral snout about 2/5 of head width; rear ends of eyes slightly anterior to about opposite upper symphysis of mouth; mouth rather broadly arched; anterior teeth with short, stout cusps, not serrated, posterior teeth cuspless, keeled, somewhat expanded, and resembling the molariform teeth of Heterodontus species. First dorsal moderately falcate, its origin over inner margins of pectoral fins and well behind their insertions, its free rear tip usually somewhat anterior to pelvic origins; second dorsal fin moderately high, about as high as anal, with a strongly concave posterior margin; its inner margin moderately long, less than twice fin height, and ending well ahead of upper caudal origin; pelvic fins not falciform, with posterior margins straight or nearly so; anal fin larger than second dorsal fin and rather long, its base 6.4 to 8.5% of total length, its origin well in front of second dorsal origin, its posterior margin shallowly concave to nearly straight. Total vertebral centra 142 to 173. A small hammerhead, to about 1.5 m. Colour grey or grey-brown above, light below, often with small dark spots on sides of body.

Geographical Distribution : Western Atlantic: From North Carolina and exceptionally Rhode Island, USA, to southern Brazil, also Cuba and the Bahamas. Eastern Pacific: Southern California, USA to Ecuador.



Habitat and Biology : An abundant, inshore, coastal, continental and insular shelf species, in shallow water over mud and sand bottoms, also on coral reefs; commonly found in eastuaries, shallow bays and channels, at depths between 10 and 25 m, but down to at least 80 m and into the surf zone and the intertidal. Off Florida it fluctuates in numbers with the seasons, being virtually absent in summer but present in numbers in spring and autumn; large schools have been seen in the autumn there. Along the Atlantic coast of the USA it is a common summer visitor as far north as New England, but it apparently migrates southward with decreasing water temperatures in autumn and winter. Considerable sexual segregation occurs in this species as in many others, and adult females often predominate in the shallows during the pupping season. This shark usually occurs in small groups of 3 to 15 individuals, and seldom is found alone.

In a pioneering six-month behavioural study of a colony of ten bonnetheads in a semi-natural enclosure in Florida, Myrberg & Gruber (1974) were able to elucidate the complex and subtle behaviour of this shark. Some eighteen postures and action patterns were discovered, along with a diel rhythm of activity peaking in the late afternoon and a definite dominance hierarchy at least partially based on size and sex. About half of the action patterns had a social content, and some agonistic behaviour was observed, though the sharks had a low level of intraspecific aggression and never fought. The sharks were very active and in seemingly constant motion day and night: they normally engaged in "patrolling" in a straight line just above the bottom, with larger sharks moving faster than smaller. These sharks might suddenly engage in "manouvering", whipping around in sharp lateral turns apparently to orient to a given spot or a prey item; and "explosive-glide", suddenly swimming rapidly followed by a long glide and sometimes a darkening in colour. Other action patterns by single sharks included "head-shake", lateral shaking of the head to left and right; "head-snaps", rolling of the shark followed by a slight upward and rapid and long downward displacement of its head, in a diagonal plane; "jaw-snap", opening and closing the mouth rapidly in succession once or twice, occurring during feeding sessions or when "patrolling"; "chafe", suddently rolling with the body coming in minimum contact with the bottom, possibly to remove parasites; "gill-puff", momentary expansion of the gill area often seen after a shark ingested something or after tight "manouvering" that disturbed the substrate, possibly to clear the pharynx; and two patterns by males, simple "clasper-flexion", flexing a clasper anteriorly while "patrolling", and "clasper-flexion-with thrust", rolling to one side, flexing a clasper, and then accelarating at speed for a few metres. Action patterns with a social context include "circling-head-to-tail", where two sharks tightly circle each other head to tail; "approach-over-the-body", sudden overtaking of a shark by another from the rear, placing the approaching shark with its head about opposite the predorsal back of the other; "hit", an "approach-over-the-body" culminating in a ventral flicking of the head by the approaching shark onto the interdorsal back of the approached shark, which accelerates off and often shows a contused area where the first shark struck it; "hunch", arching the back, displacing the pectoral fins downward, dropping the caudal fin and raising the head, done in the presence of other bonnetheads and human observers; "turn-back", one shark going in the opposite direction reverses course and follows a second; "follow", one shark closely following another and repeating its movements; "follow-formation", three to six sharks following a leader in a single line, and varying their course after the leader's movements; and "give-away", with two sharks on a head-on collision course, having one deflecting to either side of the other. "Approaches" and "hits" were often scored by resident sharks on newcomers to the containment, especially by small males and females. The "hunch" is similar in many of its components to the spectacular threat display of the grey reef shark (Carcharhinus amblyrhynchos) and probably is also a threat display. "Turn-back", "follow", and the rare "follow-formation" were usually seen in the context of males following females, but sometimes the reverse occurred. "Give-away" data pointed to the existence of a definite social hierarchy, in which the largest shark, a female, was dominant and never gave way to any of the others in head-on approaches, but in which larger males may have been more dominant than equal-sized females. Territoriality, either by individuals or by the group, was not apparent in Myrberg & Gruber's experimental bonnethead colony.

Viviparous, with a yolk-sac placenta; number of young 4 to 16 per litter. Off Florida there may be a spring and autumn mating season in the bonnethead, or alternatively mating the year round. Off Brazil it apparently mates in the spring.

The bonnethead is primarily a crustacean feeder that eats crabs, shrimp, manis shrimp, isopods, and even barnacles, but also bivalves, octopi and small fish.

Size : Maximum about 150 cm, males maturing between 52 and 75 cm and reaching at least 124 cm, females mature at 84 cm or less and reaching at least 130 cm; size at birth about 35 to 40 cm.

Interest to Fisheries : An abundant inshore shark, commonly taken by smallscale fisheries; caught with shrimp trawls, trammel nets, bottom longlines, and hook-and-line, and utilized fresh, fresh frozen, or dried salted for human consumption; also processed into fishmeal.

Literature : Springer (1938); Bigelow & Schroeder (1948); Baughman & Springer (1950); Clark & von Schmidt (1965); Sadowsky (1965, 1967); Gilbert (1967); Myrberg & Gruber (1974); Compagno & Vergara (1978); Compagno (1979).

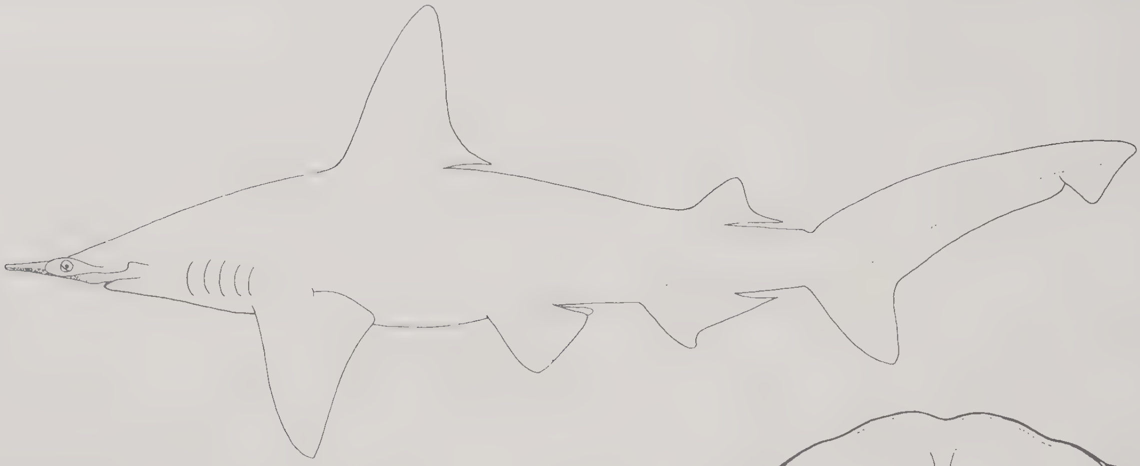
Sphyrna tudes (Valenciennes, 1822)

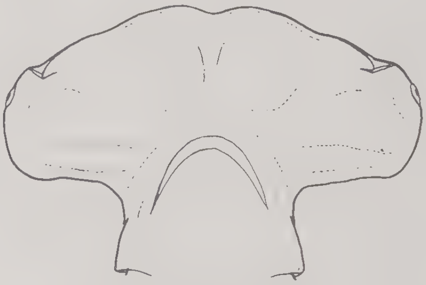
SPHYRN Sphyrn 8

Zygaena tudes Valenciennes, 1822, Mem.Mus.Hist.Nat.Paris, 9:225, pl. 2, fig. 1. Lectotype: Museum National d'Histoire Naturelle, Paris, MNHN 1049, 346 mm immature female, designated by Gilbert (1967:65). Syntypes in Museum National d'Histoire Naturelle, Paris, MNHN 1019, from Cayenne, French Guiana, MNHN 1049, a 346 mm female from off Nice, France, and a third specimen, apparently lost, from Coromandel, India. MNHN 1049 was selected as a lectotype by Gilbert (1967; see remarks below). Type Locality: Nice, France, Mediterranean Sea.

Synonymy : Sphyrna bigelowi Springer, 1944.

FAO Names : En - Smalleye hammerhead; Fr - Requin-marteau à petits yeux; Sp - Cornuda ojichica.





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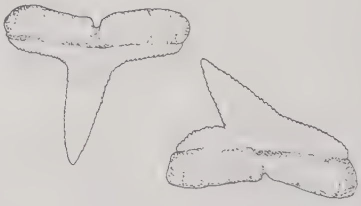
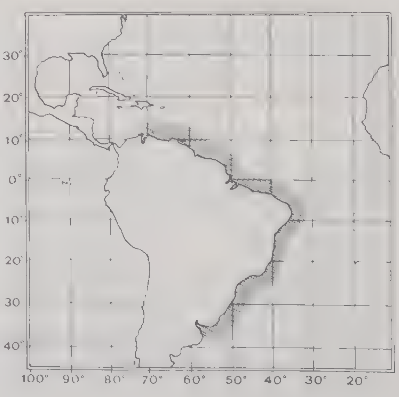


upper and lower tooth

Field Marks : A small hammerhead with a moderately broad, anteriorly arched, mallet-shaped head with medial and lateral indentations on its anterior edge and transverse posterior margins, strong prenarial grooves present on front edge of head, snout rather short and less than 1/3 of head width, moderately large, broadly arched mouth, free rear tip of first dorsal fin over pelvic insertions, posterior margin of anal fin moderately concave and not deeply notched.

Diagnostic Features : Expanded prebranchial head hammer-or axe-shaped and very wide but longitudinally fairly long, its width 28 to 32% of total length (mostly above 28%); distance from tip of snout to rear insertions of posterior margins of expanded blades about 2/5 of head width; anterior margin of head broadly arched with prominent medial and lateral indentations; posterior margins of head wide, transverse, and generally broader than mouth width; well-developed prenarial grooves present anteromedial to nostrils; preoral snout about 1/4 to slightly less than 1/3 of head width; rear ends of eyes slightly anterior to upper symphysis of mouth; mouth rather narrowly arched; anterior teeth with moderately long, slender, smooth or weakly serrated cusps, posterior teeth mostly cuspidate and not keeled and molariform. First dorsal slightly falcate, its origin slightly behind pectoral insertions, its free rear tip about over pelvic origins; second dorsal fin fairly high, less than anal height, with a shallowly or moderately concave posterior margin; its inner margin moderately long, but less than twice fin height, and ending well in front of upper caudal origin; pelvic fins not falcate, with straight or slightly concave posterior margins; anal fin larger than second dorsal fin and rather long, its base 7.5 to 9.9% of total length; its origin well ahead of second dorsal origin, its posterior margin shallowly to moderately concave. Total vertebral centra 195 to 202. A small hammerhead, to 1.5 m. Colour grey-brown above, light below, fins without markings.

Geographical Distribution : Western Atlantic: Venezuela to Uruguay. Records of this species from off Mississippi in the northern Gulf of Mexico (Gilbert, 1967a) were probably incorrect (Robins et al., 1980). The original Mediterranean record of this shark by Valenciennes (1822) may also be incorrect and based on S. couardi (Cadenat & Blache, 1981; see remarks below).



Habitat and Biology : A little-known inshore shark of the continental shelf, found down to at least 12 m depth.

Viviparous, with a yolk-sac placenta; number of young probably 6 to 9 per litter.

Feeds on small bony fishes, including sea catfish and grunts, but also newborn scalloped hammerheads (S. lewini), swimming crabs, squid, and shrimp.

Size : Maximum about 150 cm, adult males 110 to 134 cm, adult females 120 to 148 cm; size at birth about 30 cm.

Interest to Fisheries : A locally abundant species taken in coastal fisheries but with details of gear and utilization not reported. Reported very common off the Guianas in the western Atlantic but uncommon elsewhere there and rare in the eastern Atlantic and Mediterranean.

Literature : Bigelow & Schroeder (1948); Tortonese (1950a); Sadowsky (1965, 1967); Gilbert (1967, a); Compagno (1979, 1981); Cadenat & Blache (1981).

Remarks : The name Sphyrna tudes was long applied to the great hammerhead (see Bigelow & Schroeder, 1948), while Springer (1944) described S. bigelowi for the present species. However, Tortonese (1950a) and Gilbert (1967) noted that the specimen illustrated by Valenciennes (1822) as S. tudes from Nice, France and another late embryo mentioned by him from Cayenne, French Guiana (the two remaining syntypes in the Museum National d'Histoire Naturelle, Paris) are conspecific with Springer's material of S. bigelowi, and that the next available name, S. mokarran, must be used for the great hammerhead. Gilbert (1967) suggested that the third, lost syntype of S. tudes from Coromandel, India was actually based on the great hammerhead, but in its absence he considered S. tudes as the proper name for this species, the smalleyed hammerhead, and considered S. bigelowi a junior synonym (following Tortonese, 1950a). Gilbert took the step of naming MNHN 1049 from Nice, France, as the lectotype of S. tudes and MNHN 1019 from Cayenne as its paralectotype to stabilize S. tudes but he may have achieved the opposite effect. Cadenat & Blache (1981), after examining the two Paris specimens, suggested that these in fact represented two species, the Cayenne specimen being conspecific with material of S. bigelowi Springer, but the designated lectotype from Nice is based on a fetus of S. couardi Cadenat, 1950! If this is correct and Gilbert's lectotype designation is followed, S. tudes must be considered a senior synonym of S. couardi and used for the whitefinned hammerhead, while S. bigelowi must be revived for the smalleyed hammerhead. This would not serve nomenclatorial stability, but an alternate solution, rejection of Gilbert's lectotype designation and redesignation of the Cayenne specimen as the lectotype of this species, would allow the retention of the present nomenclature: S. tudes for the western Atlantic smalleyed hammerhead and S. couardi for the eastern Atlantic whitefinned hammerhead. However, this would require a petition to the International Commission on Zoological Nomenclature and an Opinion by that body. The writer has not seen the syntypes in question and cannot confirm Cadenat & Blache's observations at present, so for this account Gilbert's arrangement is retained as a temporary expedient. The identity of the Nice specimen with S. couardi would explain why no specimens of the smalleyed hammerhead have been collected in the eastern Atlantic or Mediterranean Sea.

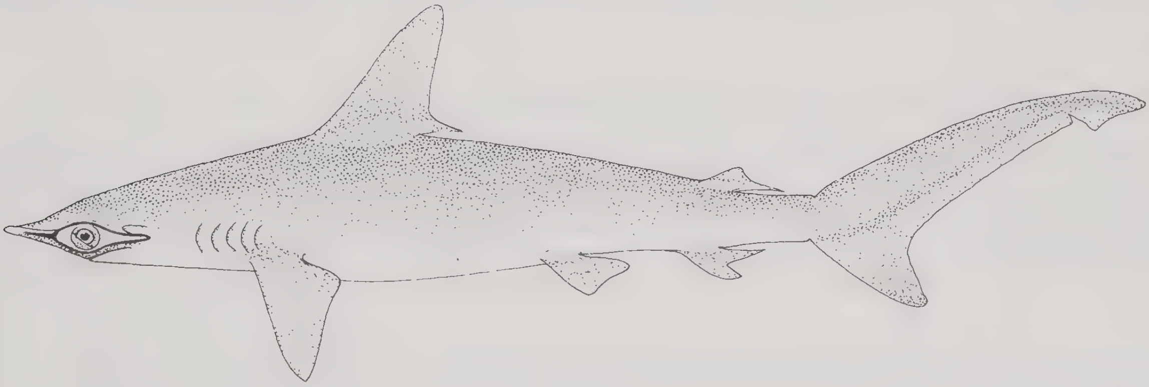
Sphyrna zygaena (Linnaeus, 1758)

SPHYRN Sphyrn 4

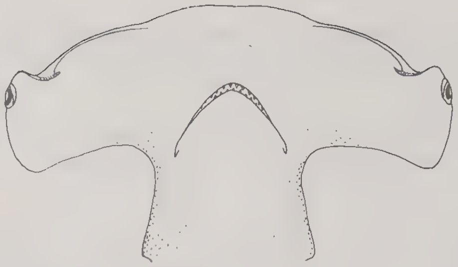
Squalus zygaena Linnaeus, 1758, Syst.Nat., ed. 10, 1:234. Holotype: None. Type Locality: "Habitat in Europa, America".

Synonymy : Squalus malleus Shaw & Nodder, 1796; ? Squalus (Cestrorhinus) caroliniensis Blainville, 1816 (nomen nudum); ? Squalus (Cestrorhinus) pictus Blainville, 1816 (nomen nudum); Zygaena vulgaris Cloquet, 1830; Zygaena subarcuata Storer, 1848.

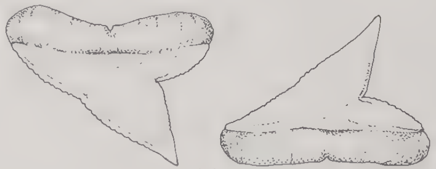
FAO Names : En - Smooth hammerhead; Fr - Requin-marteau commun; Sp - Cornuda cruz.



Field Marks : An easily recognized large hammerhead with a broad, narrow-bladed head, anterior margin of head broadly arched in adults and without a median indentation at any stage, teeth with very broad cusps and smooth to weakly serrated edge, moderately falcate first dorsal fin with free rear tip in front of pelvic origins, low second dorsal fin with weakly concave posterior margin and long inner margin about twice fin height, non-falcate pelvic fins, and a deeply notched posterior anal margin.



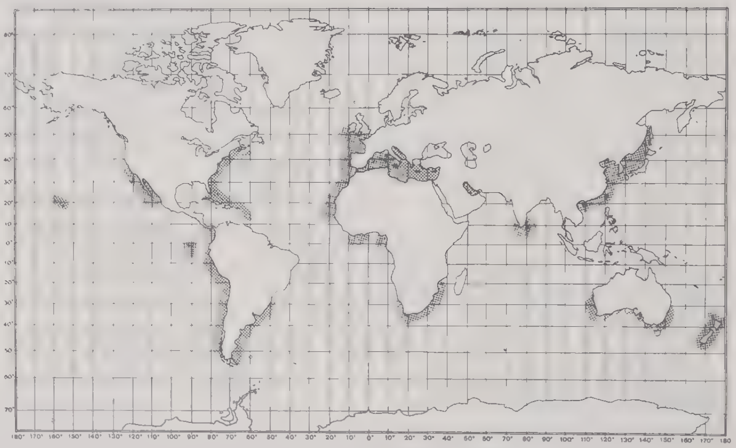
underside of head



upper and lower tooth

Diagnostic Features : Expanded prebranchial head hammer- or axe-shaped and very wide but longitudinally short, its width 26 to 29% of total length (mostly above 26%); distance from tip of snout to rear insertions of posterior margins of expanded blades less than half of head width; anterior margin of head very broadly arched with prominent lateral indentations, but no medial indentation; posterior margins of head wide, angled posterolaterally, and generally broader than mouth width; well-developed prenarial grooves present anteromedial to nostrils; preoral snout about 1/5 to less than 1/3 of head width; rear ends of eyes slightly behind upper symphysis of mouth; mouth rather broadly arched; anterior teeth with moderately long, very stout cusps, and smooth or weakly serrated edges, posterior teeth mostly cuspidate and not keeled and molariform. First dorsal moderately falcate, its origin over pectoral insertions, its free rear tip well anterior to pelvic origins; second dorsal fin low, less than anal height, with a shallowly concave posterior margin; its inner margin long, about twice fin height, and ending well in front of upper caudal origin; pelvic fins not falcate, with straight or slightly concave posterior margins; anal fin slightly larger than second dorsal fin and rather long, base 4.3 to 5.7% of total length; its origin slightly ahead of second dorsal origin, its posterior margin deeply notched. Total vertebral centra 193 to 206. A large hammerhead to over 3 m. Colour dark olive or dark grey-brown above, white below, undersides of pectoral fin tips dusky.

Geographical Distribution : Amphitemperate and tropical. Western Atlantic: Nova Scotia to Florida and Virgin Islands; southern Brazil to southern Argentina. Eastern North Atlantic: Mediterranean and British Isles to Senegal, Cape Verde Islands, Guinea, and Ivory Coast. Western Indian Ocean: South Africa and southern Mozambique, India and Sri Lanka. Western Pacific: Viet Nam (Gulf of Tonkin) to southern Japan and southern Siberia; Australia (New South Wales, Western Australia), New Zealand. Central Pacific: Hawaiian Islands. Eastern Pacific: Northern California to Gulf of California, Panama, Galapagos Islands, Ecuador to Chile.



Habitat and Biology : An active, common, coastal-pelagic and semi-oceanic hammerhead, found close inshore and in shallow water over the continental and insular shelves to offshore, at depths from the surface down to at least 20 m and probably much more. In the East China Sea, this hammerhead apparently occurs at or near the surface, while S. mokarran and S. lewini range into deeper water. This is apparently the hammerhead most tolerant of temperate waters, and has been thought to be only amphitemperate in its distribution; however, it definitely occurs in the tropics in places such as the Gulf of Mannar off southern India and Sri Lanka and off southern Mozambique, but its tropical range is spottily known at present due to probable confusion with the more abundant S. lewini. In some localities, such as off the eastern Cape of South Africa, it may occur in enormous migrating schools of young sharks 1.5 m or less long.

Viviparous, with a yolk-sac placenta; number of fetuses 29 to 37 per litter.

Feeds on a variety of bony fishes, including herring and menhaden, sea catfishes, sea bass, spanish mackerel, and porgies, and also small sharks, skates, stingrays, shrimp, crabs, barnacles, and squid and other cephalopods. Small sharks, skates and stingrays are especially favoured, and sharks are readily scavanged from nets and hooks. This species is regarded as being dangerous to people, though of the several attacks by large hammerheads only a few can be tentatively attributed to this species due to their occurrence in temperate waters. Off southern California, hammerheads apparently of this species have stolen catches from sportsfishermen and divers.

Size : Maximum about 370 to 400 cm, adults maturing at about 210 to 240 cm, adult males to at least 256 cm, adult females at least 304 cm; size at birth 50 to 61 cm.

Interest to Fisheries : A common to abundant species caught with pelagic longlines, handlines, and even pelagic and bottom trawls. It is utilized fresh, dried salted, and possibly smoked for human consumption; hides are processed for leather; liver oil is extracted for vitamins; fins are processed into shark fin soup base; and carcasses utilized for fishmeal.

Literature : Bigelow & Schroeder (1948); Garrick & Schultz (1963); Limbaugh (1963); Springer (1963); Randall (1963); Carvallo (1967); Gilbert (1967, a); Taniuchi (1974); Bass, D'Aubrey & Kistnasamy (1975a); Compagno (1979, 1981); Cadenat & Blache (1981).

10. APPENDIXES

10.1 SHARK ATTACK

Introduction : There is no other aspect of the biology of sharks that has attracted more attention than their occasional attacks on human beings. While sharks as a group are poorly known biologically, much anecdotal, emotional and misleading information is available about the minor phenomenon of shark attack. Additionally, a massive corpus of excellent scientific work has emerged centred on the shark attack question but ranging far beyond it. Although a number of important general works on sharks are available, these seem for the most part to be obsessed with shark attack, and overlook or play down the diversity of sharks in their concern with the uncommon misdeeds of a minority of the species. As this Catalogue primarily deals with sharks in a taxonomic and biological light, and as several books and collections of papers as well as numerous articles have been written about the subject, the shark attack 'problem' is not dealt with exhaustively here or elsewhere in these volumes. For much more on this subject see Whitley (1935, 1940, 1951a), Llano (1957), Coppleson (1958), Davies (1964), Follett (1966, 1974), Schultz (1967), Lineaweaver & Backus (1969), Baldridge (1973, 1974), Ellis (1976, 1983), Klimley (1978), Wallett (1978), Gilbert (1981), Miller & Collier (1981), Nelson (1981), and particularly the excellent collections of papers edited by Gilbert (1963) and Zahuranec (1983).

The writer's viewpoint is that of a biologist specializing in the systematics, morphology and evolution of cartilaginous fishes, and conducting research not on the anthropocentric phenomenon of shark attack, but the selachocentric phenomenon of shark diversity. The writer himself has no special fear of sharks, but maintains considerable respect for the larger species and has as little interest in the gory details of shark attacks as in those of the far more frequent automobile accidents. To the writer, the popular obsession of people with the subject has seemed to be more of a problem of human psychology and philosophy than a rational reaction to an objectively major and important problem.

Some sharks do attack people, undoubtedly, but the attack rate is very low, much less than the frequency of other aquatic mishaps that afflict people. Baldridge (1973, 1974) estimated that from 1940, attacks on a worldwide basis averaged about 28 a year, in no year up to 1974 surpassing 56, while Gilbert (1981), basing a revised estimate on long experience with the shark attack problem, indicated that about 30 to 50 shark attacks were reported each year worldwide, but at most less than 100 attacks, with 25 to 30 fatalities, occurred worldwide each year. Probably far more important to humans is damage to gear and fish catches by sharks, and time spent dealing with unwanted catches of sharks in those maritime countries where sharks are underutilized fishes.

Nelson (1981), with many years of underwater research on shark behaviour to his credit, notes that a number of species he and other researchers have observed are intraspecifically quite unaggressive, relative to many other vertebrates, but may show interspecific aggression to other sharks and even people, as dramatically documented with the grey reef shark (Carcharhinus amblyrhynchos). Popular belief has it that shark attacks on people are feeding attacks, but analysis of over 1000 attacks in the International Shark Attack File by Baldridge (1963, 1964) suggested to him and also Nelson (1981) that half to 3/4 of the attacks might have been non-feeding, aggressive attacks; victims of such attacks show single slash-wounds, without substantial removal of flesh. 'Mistaken identity' of humans for pinniped prey (McCosker, 1981) or deliberate 'investigation' and rejection of humans as food items (Miller & Collier, 1981) have been suggested for many white shark attacks, but either hypothesis is hard to separate from aggressive or defensive threat, and there is no compelling reason to eliminate one in favour of any of the others. The important point for the victims of such attacks is that the sharks usually inflict far less damage than they are capable of producing if they were actively feeding.

Fear of sharks and shark attack is a MAJOR phenomenon in many countries, and has resulted in millions of dollars being spent on attack-centred research and anti-shark measures, particularly on shark repellents, anti-shark weaponry, and expensive shark-meshing programmes. On coastlines with popular bathing beaches in some countries a few shark attacks each year may mean an economic disaster for the beachside resorts and communities, and hence funds have been allocated in some places, notably Australia and South Africa, to deal with the problem by shark meshing. Considerable progress has recently been made in repellent research (see Zahuranec, 1983) that may eventually result in non-lethal alternatives to killing sharks to ward against potential attacks. Presumably shark fear has also lead to the massive success of the various JAWS movies in the mid-seventies' and early eighties', portraying a savage, gory-toothed shark archetype of great popular appeal but little resemblance to any of the living species.

The Taxonomy of Shark Attack : As documented in this Catalogue, most sharks are small and harmless to humans, and a number of larger species are confined to deep water where they cannot interact with people. A survey by the writer (Compagno, 1981) showed that about 82% of shark species attained a maximum total length between 20 cm and 2 m, and that the average maximum adult size for sharks was about 1.5 m. Most of the species indicted in shark attacks are large species between 2 and 8 m or more.

"A guide to the kinds of potentially dangerous sharks" was presented by Garrick & Schultz (1963). An updated, abbreviated taxonomic guide to these species is given as follows:

Order Hexanchiformes, Family Hexanchidae : Broadnose sevengill shark, *Notorynchus cepedianus*. The only large hexanchid that frequents shallow water. Suspected of a few unprovoked, non-fatal attacks on swimmers, it has attacked divers in captivity. Omnivorous habits, size, and aggressiveness when aroused make this species at least potentially dangerous. The larger bluntnose sixgill shark, *Hexanchus griseus* lives in deep water and does not normally come in contact with people.

Order Squaliformes, Family Squalidae : Greenland shark, *Somniosus microcephalus*. Old, unconfirmed tales of this very sluggish shark attacking Eskimos in kiyaks have not been verified. The closely related Pacific sleeper shark, *S. pacificus*, has never been indicted in attacks on people. Both of these large sharks are regarded as potentially dangerous, but minimally so because of their habitat.

Order Squatiniformes, Family Squatinidae : Angelsharks, *Squatina* species. Angelsharks have strong jaws and needle teeth, and can bite painfully when accosted. They are not regarded as particularly dangerous, however, because of their small size (most below 1.5 m). *S. dumeril*, *S. californica*, and an Australian species have been cited as biting people.

Order Orectolobiformes, Family Orectolobidae : Wobbegongs, *Eucrossorhinus*, *Orectolobus*, and *Sutorectus* species. Wobbegongs are collectively infamous for biting people who walk on the coral reefs they frequent, but little is known about their behaviour generally or in regard to attacks. Probably the spotted wobbegong, *O. maculatus*, has attacked people, and the tasseled wobbegong, *E. dasypogon* is said to attack and kill people in New Guinea on uncertain evidence, but other species are currently not implicated. Larger wobbegongs should be considered dangerous because of their strong jaws and dagger-like teeth, but they probably do not normally feed on large mammalian prey and may attack primarily when accosted or presented with the limbs of a potential victim.

Family Ginglymostomatidae : Nurse shark, *Ginglymostoma cirratum*. A large, small-toothed shark credited with several provoked and unprovoked attacks, none fatal. Divers often harass this shark, which may respond by biting them, but nurse sharks are generally unaggressive when left alone. Attacks may be defensive or non-feeding aggression, as this shark normally feeds on small prey.

Tawny nurse shark, *Nebrius ferrugineus*. Said to be more docile than the nurse shark, and readily allowing handling by divers, but credited with a few provoked attacks.

Family Rhiniodontidae : Whale shark, *Rhiniodon typus*. Unaggressive to divers but occasionally bumps boats that are reeling in game fishes. Not considered dangerous despite its great size.

Order Lamniformes, Family Odontaspididae : Sand tiger, grey nurse or ragged-tooth shark, *Eugomphodus taurus*. A large sluggish shark involved in a number of abortive, non-feeding attacks on people, none apparently fatal, generally unaggressive to divers but will steal speared fishes. Feeds on smaller prey, not on mammals; may be mainly dangerous to people when accosted or presented with their limbs only. Two other large species in the family, *Odontaspis ferox* and *O. noronhai*, are deepwater sharks with smaller teeth than the sand tiger, and have never been implicated in attacks on people.

Family Alopiidae : Thresher shark, *Alopias vulpinus*. Two unconfirmed boat attacks may have been due to this species; also, an anecdotal account of a fisherman being decapitated by the tail of a large adult while attempting to land it could not be verified. Probably not normally dangerous; approaches divers without being aggressive. Two other species in the family, the bigeye thresher, *A. superciliosus*, and the pelagic thresher, *A. pelagicus*, have never been indicted in attacks on people.

Family Cetorhinidae : Basking shark *Cetorhinus maximus*. May attack boats when harpooned, but unaggressive to divers and not considered dangerous despite its great size.

Family Lamnidae : Great white shark, *Carcharodon carcharias*. Currently one of the three most dangerous sharks, and often considered *the* most dangerous shark by virtue of the number of attacks (possibly between 50 and 100) than can be attributed to it worldwide in this century on swimmers, surfers, divers and boats. Several white shark attacks have been fatal, though most are not due to their abortive or tentative nature. An aggressive, bold species, feeding on large prey, but apparently not living up to its JAWS reputation in regard to humans; sometimes approaches divers, perhaps out of curiosity, and departs without attacking. Should be treated with great caution.

Shortfin mako, *Isurus oxyrhynchus*. A large, very fast, dangerous species, with a few unprovoked non-fatal attacks on swimmers and rather more on boats, particularly after being hooked. Can be aggressive to divers, gives a figure-8 swimming display and jaw gapes as possible threat, should be treated with caution.

Longfin mako, *Isurus paucus*. Not indicted in attacks, but should be treated as potentially dangerous because of its size and large teeth. Possibly more sluggish than the shortfin mako.

Salmon shark, *Lamna ditropis*, and porbeagle, *L. nasus*. Not indicted for certain in attacks, and probably not particularly dangerous because of their smallish teeth and fisheating habits, but the size of adults should invite respect. Divers have encountered the salmon shark in California waters without incident.

Order Carcharhiniformes, Family Triakidae : Leopard shark, Triakis semifasciata. A small shark once reported as having harassed a diver with a nosebleed; ordinarily flees when approached underwater, and not considered dangerous.

Family Hemigaleidae : Snaggletooth shark, Hemipristis elongatus. A medium-sized fisheating shark with formidable teeth, considered potentially dangerous but never indicted in a shark attack.

Family Carcharhinidae : Silvertip shark, Carcharhinus albimarginatus. A large, aggressive, common, potentially dangerous shark that favours offshore islands but with few if any attacks attributed to it.

Bignose shark, Carcharhinus altimus. A large, fisheating shark found in deepish water, not likely to come in contact with people except for fishermen who catch it.

Graceful shark, Carcharhinus amblyrhynchoides. A narrow-toothed medium-sized fisheating shark similar to C. limbatus, and of a limited potential danger, not implicated in shark attacks.

Grey reef shark, Carcharhinus amblyrhynchos. A common small to medium-sized reef shark, sometimes very aggressive and involved in several attacks on people, at least one fatal. May give a threat display when cornered, and bold in taking speared fish.

Pigeye or Java shark, Carcharhinus amboinensis. A heavy-bodied large inshore shark with no attacks attributed to it but potentially dangerous because of its omnivorous habits, powerful jaws and large triangular teeth. Likely to be confused with the bull shark, C. leucas.

Copper shark or bronze whaler, Carcharhinus brachyurus. A common large shark with a few provoked and unprovoked attacks on swimmers and divers ascribed to it. Probably less dangerous than the bull and tiger sharks because of its relatively slender teeth and primarily fisheating habits.

Spinner shark, Carcharhinus brevipinna. A medium-sized shark with one unprovoked, non-fatal attack ascribed to it; probably not particularly dangerous as teeth are small and diet is largely fish.

Silky shark, Carcharhinus falciformis. A large aggressive oceanic shark, regarded as dangerous or potentially dangerous, although definite attacks cannot be attributed to it. Possibly involved in attacks following air-sea disasters, like the oceanic whitetip shark.

Galapagos shark, Carcharhinus galapagensis. A large, dangerous shark that favours offshore islands, and definitely responsible for one fatal attack on a swimmer; young sharks can be very abundant and aggressive, and have harassed divers to the point of causing operations to be suspended.

Bull, Zambezi or Lake Nicaragua shark, Carcharhinus leucas. An inshore, heavy-bodied shark that ranges widely into fresh water. One of the three most dangerous sharks; several fatal and non-fatal attacks are attributed to it, and it may very well turn out to be the most dangerous shark because of its wide range in the tropics, proximity to human activities and omnivorous habits. Probably at least partly responsible for the bloody reputation of the Ganges shark.

Blacktip shark, Carcharhinus limbatus. A medium-sized dangerous or potentially dangerous shark with at least one attack ascribed to it; may harass spearfishers and steal their catch, but probably less dangerous than more omnivorous sharks like the bull shark.

Oceanic whitetip shark, Carcharhinus longimanus. A large, bold, dangerous shark of the open seas, with several attacks definitely attributed to it, and perhaps chiefly responsible for a large number of deaths in the aftermath of at least one sinking of a ship by submarine. Has approached divers in the open ocean and stubbornly persisted in investigating and circling them, showing little fear in response to their defensive actions. Probably one of the more dangerous sharks.

Blacktip reef shark, Carcharhinus melanopterus. A small, active fisheating shark, of limited dangerousness; responsible for a number of attacks on spearfishers and waders without major injuries or fatalities; most attacks are on the limbs of people wading in shallow water on coral reefs, and may be a case of 'mistaken identity' for its usual prey.

Dusky shark or black whaler, Carcharhinus obscurus. A large shark that eats mainly fish and invertebrates, involved in a few attacks on people but probably less dangerous than bull or tiger sharks.

Caribbean reef shark, Carcharhinus perezi. A large, little-known dangerous shark involved in at least one abortive attack.

Sandbar shark, Carcharhinus plumbeus. A medium-sized shark that is considered potentially dangerous because of its abundance and large, triangular teeth, but never implicated in an attack on people and unlikely to attack because of its strong preference for fresh fish and invertebrate prey.

Night shark, Carcharhinus signatus. A large semioceanic shark, not implicated in shark attacks and unlikely to be involved in such because of its deepwater habitat and fisheating habits.

Blackspot shark, Carcharhinus sorrah. A small, common active reef shark, feeding on small fishes and not known to have attacked people; has minimal potential danger.

Blacktail reef shark, Carcharhinus wheeleri. Very similar to the grey reef shark, and possibly identical; considered potentially dangerous because of its aggressiveness when divers are spearing fish.

Tiger shark, Galeocerdo cuvier. One of the three most dangerous sharks, involved in several fatal and non-fatal attacks on people and in boat attacks. Perhaps the most omnivorous of sharks, prone to sample unusual items, and sometimes inquisitive and very aggressive underwater. It should be treated with great caution when encountered underwater.

Ganges shark, Glyphis gangeticus. A poorly known medium-sized or large inshore and riverine shark with a frightful reputation as a 'maneater' in the Ganges-Hooghly system of India, which cannot be confirmed because of its rarity and the presence of the bull shark in the same river system.

Speartooth shark, Glyphis glyphis. A poorly known medium-sized inshore shark, with no attacks attributable to it.

Broadfin shark, Lamiopsis temmincki. A poorly known smallish inshore shark with broad triangular upper teeth, potentially of minimal danger but not known to have attacked people.

Sharptooth lemon shark, Negaprion acutidens. A large, heavy shark that is dangerous when provoked. Adults may be unaggressive and flee divers when approached, but if speared, poked or otherwise accosted may respond with a vigorous attack.

Lemon shark, Negaprion brevirostris. Very similar to the sharptooth lemon shark in often responding to abuse with a vigorous attack. Although involved in a few unprovoked attacks on bathers and swimmers, more often recorded as attacking divers and boats after being disturbed or injured.

Blue shark, Prionace glauca. A large, dangerous, often inquisitive oceanic shark with several attacks on boats and divers, often after much circling. More timid than the oceanic whitetip or shortfin mako, and often eating rather small prey.

Reef whitetip shark, Triaenodon obesus. A smallish shark that occasionally attacks divers, especially when excited by spearfishing and baits, but which is regarded as minimally dangerous because of its general timidity and small teeth.

Family Sphyrnidae : Large hammerhead species, including the scalloped or bronze hammerhead, S. lewini, great hammerhead, S. mokarran, and smooth or black hammerhead, S. zygaena. A small number of attacks can be attributed to larger hammerheads, with species identity uncertain. Although all these species are at least potentially dangerous, divers have repeatedly observed scalloped and great hammerheads in unbaited situations and found them to be unaggressive. Hammerheads may be more bold with speared fish about, as with several carcharhinids. Another large species, the whitefin hammerhead, Sphyrna couardi, is poorly known and has never been indicted in attacks on people, but may be considered potentially dangerous.

Summary of Dangerous Species

The sharks surveyed above can be subdivided into the following categories:

A. Sharks that have attacked people or boats = 27.

- **(i)** Very dangerous = 4?: numerous injurious attacks on people, including several fatalities: Great white shark, tiger shark, bull shark, oceanic whitetip shark?
- **(ii)** Dangerous = 17?: one to several attacks on people, capable of inflicting moderate to severe injury or death but few if any fatalities; spotted and tasseled wobbegongs, nurse shark, tawny nurse shark, sand tiger, shortfin mako, grey reef shark, copper shark, spinner shark, Galapagos shark?, blacktip shark, blacktip reef shark?, dusky shark, Caribbean reef shark, sharptooth lemon shark, lemon shark, blue shark?
- **(iii)** Small species that are minimally dangerous or harmless = 4: Pacific angelshark and sand devil, leopard shark, whitetip reef shark.
- **(iv)** Giant filter-feeders, normally not dangerous to people in the water = 2: whale and basking sharks.

B. Sharks suspected of attacking people = 12: Broadnose sevengill, Greenland shark, Australian angelshark?, thresher shark, silvertip shark, pigeye shark, silky shark, blacktail reef shark, Ganges shark, scalloped, great, and smooth hammerheads.

C. Additional species of potential harmfulness = 28.

(i) Potentially dangerous sharks = 15: Pacific sleeper shark, 5 additional wobbegongs, 2 additional threshers, longfin mako, bignose shark, graceful shark, night shark, sandbar shark, speartooth shark, whitefin hammerhead.

(ii) Sharks of minimal potential danger = 13: 10 additional angelsharks, snaggletooth shark, blackspot shark, broadfin shark.

Of about 21 species involved in shark attacks that are considered dangerous or very dangerous, virtually all are large species between 2 and 8 m or more. Adding about 40 other species that are suspected of harming, regarded as 'potentially or suspected as dangerous' to the 27 indicted species gives a total of slightly below 20% of the known species. A majority of the sharks that have attacked people (56%) belong to the family Carcharhinidae.

The 'Human Attack Problem': Shark attack may not be a major problem for humans, but 'human attack' is a major problem for sharks. The 1976 worldwide FAO shark catch data reported by Kreuzer & Ahmad (1978) was 307 085 metric tons, which is probably a minimal figure. If one assumes that the average shark caught weighed as much as the average human being (about 68 kg, probably too high as most of the fisheries species are lighter than the average human being), the sharks killed by human attack that year were about 4.5 million individuals, not counting those that were injured and lost or those killed and thrown overboard (Compagno, 1981). Assuming Gilbert's (1981) maximum figure of 30 human fatalities a year from shark attack, the shark fatality rate from human attack is minimally about 150 000 times higher than for shark attacks on human.

With many sharks having a reproductive strategy like larger mammals, with low fecundity, long maturation periods, and long gestation periods, the present exploitation level may be depleting the stocks of many species, and even endangering their survival. This in turn would have an uncertain and possibly negative impact on the marine ecosystems that they are a part of. Clearly shark conservation and restricted exploitation of endangered species may become a necessity in the next few decades. Particularly worrisome are those inshore species, like the river sharks, Glyphis species, and the Borneo shark, Carcharhinus borneensis, that are known from very few valid records and museum specimens. A major difficulty in accessing the condition of shark populations is a general dearth of knowledge on their population biology. Another problem is that, unlike cetaceans, sharks have no positive popular appeal in many countries, being generally saddled with the obnoxious 'JAWS image' that invites lack of concern for the problems of shark overexploitation.

Advice to People Who are at Potential Risk from Shark Attack: The following advise for people who use waters frequented by dangerous or potentially dangerous sharks is derived and modified from that advocated by Gilbert (1963), Baldridge (1974), and the recent shark issue of Oceanus (1981, vol. 24, no. 4).

1. Remember that shark attack is a minor phenomenon, despite media hyperbole to the contrary. Millions of people use the oceans every year without being attacked, and your chances of being attacked are lower than being hit by lightning. The sea itself is far more dangerous. Also, it may be some comfort to realize that people are far more serious a hazard to sharks than vice-versa.

2. Do not swim, dive or surf where dangerous sharks are known to congregate. In California, for example, white shark attacks have repeatedly occurred in the same small areas favoured by these sharks.

3. Swim, dive or surf with another person or in groups, and do not stray far away from your group. Lone people are more readily attacked than a large and possibly threatening group.

4. Avoid spreading blood or human wastes in the water. Human blood may attract and excite sharks, and divers and swimmers should avoid or come out of the water with bleeding injuries or, for women, when menstruating. Similarly, feces and urine may be attractive, and should not be scattered indiscriminately where one swims or dives. Avoid swimming where raw sewage or slaughterhouse offal is dumped in the water.

5. If possible, do not swim or dive in water with high turbidity and low visibility.

6. If possible, avoid swimming or diving well offshore, in channels, at river or bay mouths or along dropoffs to deeper water where large sharks may occur.

7. If fishes begin to behave erratically or congregate in unusual numbers, leave the water. Large aggregations of fish or squid often have their attendant sharks, and should be avoided.

8. Uneven skin tanning and bright, contrasting swimsuits and wetsuits may be more attractive to sharks, and should be avoided. Some authorities have stated, however, that a black wetsuit makes one look more like a seal and increases the probability of attack by white sharks. Surfboards that contrast with the water surface from below may be more attractive to sharks. In general, low contrast is probably better to avoid attracting or exciting sharks.

9. Do not swim with pets or other domestic animals, which may attract sharks, or swim, dive, or surf too close to seal and sea lion colonies. Apart from increasing your chances of being attacked by an attendant shark near such colonies, the pinnipeds themselves may present a hazard. The near presence of dolphins, porpoises or other small cetaceans is no guarantee of the absence of sharks, contrary to popular belief. A few sharks feed on and may even follow small cetaceans.

10. Before entering the water from shore or a boat take care to scan about for sharks. In open lagoons low tide may trap sharks inside them, and these should be checked. While swimming or diving, keep a regular lookout to the open sea and all around you for approaching sharks. Particularly with divers, alertness has paid in avoiding injuries and decreasing the seriousness of shark attacks.

11. If possible, do not swim or dive at dusk or night when many sharks become more active.

12. A number of surfers have been accosted by sharks in recent years, mainly by great whites. The small paddleboards or bellyboards that are currently popular may give less protection from shark attack than the more traditional large surfboards; one scientist has suggested that such boards, with the limbs of the surfer hanging down from them, might easily be mistaken for a seal by a great white shark.

13. Attacks on small sportfishing and commercial fishing boats by sharks, mostly great whites and shortfin makos but also tiger sharks, lemon sharks and a few others, occasionally occur, particularly when the sharks are hooked. Makos in particular may wreck havoc with a small boat when hooked, and very rarely both white sharks and makos have demolished them. Boats with leaky, dirty bilges trailing fish juices may contribute to white shark attacks, along with contrasting bottom colours and bright, spinning propellors. JAWS not withstanding, large white sharks are often content to patrol under fishing boats and steal fishes that are hooked. Any large and dangerous sharks should be shot or otherwise subdued before being boarded on a boat, or confined to a penboard area separate from the rest of the deck.

14. Spearfishing increases the chances of shark encounters. If possible do not stay in a limited area for so long that trailing fish juices, or your erratic swimming while pursuing fish, attracts hungry sharks. Generally spearfishing on an outgoing tide, which may attract sharks from offshore to the fishing site, is less safe than fishing on an incoming tide, with fewer sharks likely to be inshore from the site. Do not carry speared fish on your person, or on a stringer or tether, but remove them from the water immediately.

15. Do not provoke or molest any shark by spearing it, poking it, attempting to ride it, or hanging onto its tail, no matter how small or seemingly innocuous. Even small, weak-toothed species will often bite when harassed, and some normally docile large species may defend themselves with vigor when accosted. Do not corner a shark in a place where its escape route may be blocked by you.

16. If a large shark is sighted leave the water as soon as possible. Swim as smoothly as possible to avoid exciting the shark. If diving, keep submerged and watch the shark until exit from the water can be accomplished quickly, to be able to block an attack if the shark choses to do so.

17. If a shark changes its normal smooth swimming to a jerky, rigid, unusual pattern, it may be giving a threat display; you should depart from the vicinity of such sharks as quickly as possible.

18. Divers should carry some tool or object to fend off sharks and keep distance between you and them. A 'shark billy', a 1.2 m long wooden, glass-fibre or metal club with one end roughened to give purchase against the skin of a shark is useful, and a speargun, abalone iron or knife can suffice. Some powerhead designs can double as a shark billy when unloaded, and several divers have successfully kept persistant oceanic whitetip sharks at bay with underwater cameras.

19. Use a shark cage or sharkproof small submersible if sharks in an area persist in harassing diving operations that cannot be conducted elsehwere, or if sharks are to be studied underwater in safety.

20. If a shark approaches closely and seems to be attacking, keep calm and use any object available to you to fend it off. Do not attempt to injure the shark with knife or speargun unless all else fails in deflecting its attack, as injury often makes large sharks more aggressive. Use your bare hands only as a last resort, to avoid cutting yourself on the teeth or skin of the shark.

21. Lethal anti-shark weapons like powerheads or gas guns, as well as ordinary spearguns, have their limitations and may excite a shark, cause other sharks to attack or injure a diver if improperly applied. These should be used with care and as infrequently as possible. With a powerhead or even a speargun, aim for the top of the head between the eyes, or the side of the head right through an eye.

22. Aggressive actions toward approaching sharks may be effective in deterring attacks, but some sharks may not react at all and others may become very aggressive themselves; aggressive actions should be applied judiciously. Rapid limb movements, charging the shark, shouting underwater or blowing bubbles just might abort a possible attack, and poking a shark in the eyes or in its gills has aborted several attacks. Fending off a shark may buy sufficient time to allow a rescue.

23. In most cases, people have recovered from shark attack injuries. If a person is attacked and bitten, all effort should be made to stop bleeding, even before exiting the water, and a physician should be called on to attend the victim as soon as possible.

24. Recent promising results with potential shark repellents may result in salves or ointments that can be used by divers on wet suits and possibly by swimmers on bare skin to deter sharks from biting. At least a squirt-gun applicator to shoot a repellent at an oncoming shark seems possible as a non-lethal anti-shark weapon. Work with an oversuit of stainless steel chain mail for divers suggests that such passive protection may be quite effective against some dangerous sharks, and with further development and possibly different materials against all large species. Practical anti-shark armour and repellents may be available in a few years at most. If you obtain the old US Navy 'shark chaser' repellent or its British equivalent as surplus, remember that these are of limited value at best and should not be depended on to repel a shark.

10.2 PRESERVING SHARKS FOR SCIENTIFIC STUDY

Many countries have natural history museums, and these often have fish collections with sharks and other elasmobranchs in them. In the 18th and 19th centuries museum sharks were often skinned and the skins dried and stuffed, but this was supplemented and largely replaced first by fixation and storage in high concentrations (70% or more) of ethyl alcohol (CH_3CH_2OH) solutions in water. By the beginning of the 20th century fixation in water solutions of formaldehyde gas (CH_2O) or formalin, followed by permanent storage in aqueous solutions of ethyl, isopropyl ($CH_3CHOHCH_3$) or n-propyl (CH_3CH_2CHOH) alcohols became the standard mode of preservation. Because of the extreme fire hazard with high concentrations of alcohol in some places (notably Japan, with much seismic activity and a history of large fires) or limited availability or high cost of alcohol, some collections store sharks and other fishes in weak formalin sometimes buffered, but this is far less desirable because of the excessive hardening of soft tissues, brittleness of fins, and decalcification of hard tissues in sharks long stored in formalin. A 1% solution of propylene phenoxcetol with 5% ethylene glycol in water has been used with some success as a substitute for formalin or alcohol storage after formalin fixation.

Although sharks form a relatively small group of fishlike fishes, they are poorly known, and many described species are inadequately represented in museum collections. Also, new species are still being collected at a goodly rate, especially from trawl catches on the continental and insular slopes. It is not impossible that readers of this Catalogue may come upon unusual sharks of rare species interesting to science, or even new species, and may want to preserve them for later identification and deposition in a museum collection. Hence it is desirable to briefly outline methods of preserving sharks.

Most sharks, including small species or small specimens of larger ones a metre or less long, can be preserved readily in the field or laboratory when caught. For best results sharks should be fixed with formalin as soon after death as possible, though they can be frozen or even covered with ice to halt or retard putrefaction until the specimen can be fixed or delivered to a museum for fixation. Excess freezing will dehydrate unprotected specimens, and sharks to be frozen for considerable periods should be sealed with some water in plastic bags. In hot climates it is especially important to preserve (or freeze) specimens quickly, as they can deteriorate in a matter of hours. Specimens should be kept cool, in the shade, and iced or covered with wet cloth or burlap if they cannot be immediately fixed or frozen.

Containers are necessary to fix and house the sharks, such as small barrels, cardboard liquipaks, elongated troughs, plastic garbage pails or whatever is available locally. Formalin will quickly corrode ordinary steel containers, so such should have acid-proof coatings if used for fixation. Ideally a long trough of wood, plastic, fibreglass, stainless steel or other formalin-resistant material should be used for preserving sharks in a straight position, but it may be possible in some situations only to fix and store specimens in cylindrical containers in a curled position. Tools and materials needed include several litres of 40% aqueous (concentrated) formaldehyde, a scalpel or small penknife, a fish filleting knife, a forceps, a pointed metal probe, a 20 to 50 ml hypodermic syringe with large needles (size 16 or larger), rubber gloves, good quality label paper of high rag content that will not tear easily when wet or plastic-impregnated paper that can be written on with pencil, linen or cotton string, and pencils.

To preserve a small shark, prepare a 10% formalin solution by adding 1 part concentrated formaldehyde to 9 parts of water, in a volume enough to, at least, cover the shark in the container selected. Formalin is quite toxic, and should be handled with great care, in a well-ventilated place and with protective clothing and safety glasses. Containers for fixation and temporary storage should ideally have tight-fitting lids to prevent escape of toxic formalin fumes. Make a label for the shark in pencil, with the date, locality and depth of capture, collector, field number (if any), and any other pertinent information, and either tie it to the shark (the caudal peduncle is often used) or place it inside its mouth or inside a gill slit. If a syringe is available inject a quantity of formalin into the body cavity and also the muscle masses of the body, tail, and fin bases, and the head to preserve the brain. Dilute 10% formalin can be used for injection, though higher strength formalin, 1:4, 1:2 or even undiluted concentrated formaldehyde is very effective and preferable in preventing putrefaction in hot climates. If a syringe is unavailable make several small holes or slits on the sides and body cavity of the shark with a knife, scalpel or probe, preferably on the righthand side (left side is generally used for illustration); even when injecting the shark make at least one small slit on the left side of the body cavity. Position the shark flat on its abdomen with fins spread in the preserving container and add enough dilute formalin to cover it. Fins can be pinned out on pieces of styrofoam or other soft material if necessary. With hot climates and larger sharks it may be desirable to use stronger formalin, up to 1:4, for initial fixation, or add more concentrated formaldehyde to 10% solution if outgassing from putrefaction is evident. Specimens should be fixed for at least two weeks for small sharks below 1.5 m to a month or more for larger specimens. Volume of the shark should not exceed half of the volume of the preserving fluid. If possible specimens should be stored in alcohol, after a brief wash in water to remove excess formalin.

The larger sharks, 1.5 m or more, present special storage problems, and it is often impossible to preserve them intact. However heads, fins and vertebral columns of even large sharks can be readily accommodated in barrels and other containers. To prepare a large shark for compact storage measure its total length and remove its viscera and most of its muscle mass from the pectoral fin bases to the second dorsal and anal fin with a filleting knife, leaving a long dorsal strip of skin connecting the head to the first dorsal fin, second dorsal, caudal peduncle and caudal fin, and a short ventral strip connecting the pelvic fin bases, anal fin and caudal peduncle. Strip the vertebral column of excess flesh and cut it off at the head and caudal peduncle, cut it into sections if necessary, tie labels to it and the rest of the shark, and fix it and the rest of the shark in a suitable container with at least 10% formalin or stronger, injecting the head and tail if possible.

If it is not possible to preserve any parts of a shark take black and white or colour photographs of the entire shark in lateral view and dorsal view, and the underside of its head and pectoral fins, and remove and dry a strip of teeth from the upper and lower jaws. At minimum, record the date, locality, depth, collector and any other significant data for the specimen and take the following measurements as indicated in the first volume of this Catalogue with a metre stick or tape measure: Total length, Preoral length (POR); Head length (HDL); Eye length (EYL); Mouth width (MOW); Pectoral anterior margin (P1A); Pelvic anterior margin (P2A); First dorsal height (D1H); Second dorsal height (D2H); Anal height (ANH); and Dorsal caudal margin (CDM). Take other measurements if possible.

The writer is quite willing to help any readers who have shark identification problems, and photos, measurements and tooth samples or small whole sharks can be sent to him care of FAO.

10.3 CORRECTIONS AND ADDITIONS

It is inevitable with a work of the size and scope of this Catalogue that it should become obsolete as soon as its publication. Due to a tight deadline for submitting the first volume of the Catalogue data from several important papers that appeared at the time could not be incorporated in it. Also because of the deadline, the writer was unable to proofread the galleys for volume 1 (unlike volume 2), and a number of text errors, mostly minor and typographic but with two important omissions, appeared in the first volume. Hopefully these errors will be corrected in a revised version of this Catalogue, but as a present expedient some of the more annoying errors are listed, and summaries of some of the more interesting works that could not be included in volume 1.

Corrections : **Page 1**, para. 3, Gill (1873) is (1872), Garrick (1979) is (1982), Bass, D'Aubrey & Kistnasamy (1975c) is (1975, a,b,c), Applegate et al. (1981) is (1979). **Page 4**, para. 3, to Eucrossorhinus and Orectolobus add Sutorectus. **Page 15**, para. 6, Compagno (1981) is (1981a). **Page 21**, para. 9, 'specimen' is 'specimens'. **Page 26**, para. 10, Tortonese (1958) is (1956). **Page 34**, Aculeola, Field Marks omitted, is 'blackish brown, no anal fin, small dorsal fin spines, small hook-like teeth in both jaws'; Literature omitted, is 'de Buen (1959a), Kato, Springer & Wagner (1967). **Page 35**, para. 7, Cadenat (1959) is (1959a,b,c). **Page 41**, para. 6, and **page 59**, para. 1, Regan (1908b) is (1908d). **Page 46**, para. 1, Okamura et al. is Okamura, Amaoka & Mitani. **Page 53**, para. 8, Fowler (1949) is (1941). **Page 57**, para. 4, Garrick (1959), is (1959a), Krefft & Stehmann is Krefft & Tortonese. **Page 57**, para. 15, Regan (1906) is (1906b). **Page 58**, para. 5, **page 59**, para. 1, **page 76**, para. 9, **page 85**, para. 10, Krefft (1968) is (1968a). **Page 64**, para. 6, Cadenat & Blache (1982) is (1981). **Page 68**, para. 7, Smith & Radcliffe (1912) is Smith (1912a). **Page 70**, para. 2, **page 101**, para. 10, Nakaya (1982), should be Nakaya (in Okamura, Amaoka & Mitani, 1982). **Page 95**, para. 5, **page 244**, para. 9, Strasburg is Strasberg. **Page 96**, para. 5, Kstanasamy is Kistnasamy. **Page 103**, para. 4, carcharis is carcharias in Squalus and Carcharodon. **Page 123**, Literature omitted, is 'Fourmanoir & Rivaton (1979). **Page 136**, para. 9, nudipinnis not underlined. **Page 138**. Ordinal Citation, Synonymy and Diagnostic Features omitted for Squatiniformes, should be:

Order Squatiniformes Compagno, 1973, J.Linn.Soc.(Zool.), 53, suppl. 1.

Synonymy : Order Asterospondyli, Suborder Rhinae: Gill, 1893. Order Cyclospondyli, Suborder Tectospondyli: Jordan & Evermann, 1896. Order Euselachii, Suborder Squatinoidei: Blot, 1969. Order Lamniformes, Suborder Squatinoidei: Patterson, 1967. Suborder Plagiostomi Tectospondyli: Hasse, 1879 (in part). Suborder Rajiformes: Goodrich, 1909 (in part). Suborder Rhinae: Gill, 1862, 1872. Suborder Rhiniformes: Lozano y Rey, 1928. "Group" Rhinoidei: Garman, 1913. Order Squalea, Suborder Rhinida: White, 1936, 1937. Order Squaliformes, Suborder Squatinoidei: Berg, 1940, Berg & Svedovidov, 1955, Arambourg & Bertin, 1958 (in part). Order Squaloidea, Suborder Squatinoidea: Schultz & Stern, 1948. Suborder Squaloidea: Romer, 1945, 1966 (in part), Norman, 1966 (in part). "Division" Squaloidei: Regan, 1906 (in part). Suborder Squaloidei: Engelhardt, 1913 (in part). Order Squatinae: Fowler, 1941, Smith, 1949. Order Squatinida, Suborder Squatinoidei: Glikman, 1967. Order Squatiniformes: Rass & Lindberg, 1971, Applegate, 1974, Chu & Wen, 1979. Suborder Squatiniformes: Bertin, 1939. Suborder Squatinina: Matsubara, 1955, Fowler, 1969a. Suborder Squatinoidea: Bigelow & Schroeder, 1948. Suborder Squatinoidei: Lindberg, 1971, Nelson, 1976. Order Tectospondyli, Suborder Squatinoidei: Jordan, 1923.

Diagnostic Features : Trunk greatly depressed and raylike; head greatly depressed and laterally expanded, with a distinct neck between itself and the trunk; 5 pairs of gill slits present on ventrolateral surface of head, with the posteriormost in front of pectoral fin origins; spiracles present and very large, just behind the eyes; nostrils with barbels, poorly developed nasoral grooves and weak circumnarial grooves, very close to mouth, anterior nasal flaps elongated and bordering mouth; eyes on dorsal surface of head, without nictitating lower eyelids; snout very short and truncated, not sawlike and without rostral barbels; mouth large, arched and moderately long, extending behind eyes; labial furrows very large, present on both jaws; teeth moderately differentiated along jaws, without enlarged anterior or posterior teeth and without a gap or small intermediate teeth between anterior and lateral teeth in the upper jaw; two spineless dorsal fins present, the first with its origin opposite or behind free rear tips of pelvic fins; pectoral fins very large, expanded and raylike, with unique triangular anterior lobes that extend forward from the pectoral bases and cover the gill slits laterally; pelvic fins large, with vent separate from the pelvic inner margins; anal fin absent; caudal fin with a moderately long dorsal lobe but with the ventral lobe longer than it; vertebral axis depressed into the ventral caudal lobe; intestinal valve of spiral type.

Page 150, para. 5, Poll (1950) is (1951). **Page 155**, para. 6, Tropidodus Beebe & Tee-van is Tropidopus (original mispelled). **Page 156**, para. 9, '11 to 14 intervals' is '11 to 14 day intervals', para. 10, 'echnoids' is 'echinoids'. **Page 160**, para. 8, 'selections shown' is 'selection is shown'. **Page 161**, para. 6, 'fin spine' is 'fin spines'. **Page 165**, Definition and Diagnostic Features missing for Orectolobiformes:

Synonymy : Order Asterospondyli: Gill, 1893 (in part), Smith, 1949 (in part), Fowler, 1941 (in part). Order Asterospondyli, Suborder Galei: Jordan & Evermann, 1896 (in part). Superorder Carcharhini, Order Squatinida, Suborder Ginglymostomatoidei: Glikman, 1967. Order Carcharhiniformes: Rass & Lindberg, 1971 (in part). Suborder Carchariina: Fowler, 1967a (in part). Order Euselachii, Suborder Galei: Jordan, 1923 (in part). Order Euselachii, Suborder Galeoidei: Whitley, 1940 (in part), Blot, 1969 (in part). Order Galea, Suborder Isurida: White, 1936, 1937 (in part). Suborder Galei: Gill, 1872 (in part). Order Galeiformes, Suborder Isuroidei: Arambourg & Bertin, 1958 (in part). Suborder Galeiformes: Lozano y Rey, 1928, Budker & Whitehead, 1971 (in part). "Division" Galeoidei: Regan, 1906 (in part). Suborder Galeoidei: Engelhardt, 1913 (in part). Order Lamniformes, Suborder Lamnoidei: Berg, 1940 (in part), Berg & Svedovidov, 1955 (in part), Patterson, 1967 (in part). Suborder Lamnina: Matsubara, 1955 (in part). Order Lamnoidea, Suborder Galeoidea: Schultz & Stern, 1948 (in part). Suborder Lamnoidei: Lindberg, 1971 (in part), Nelson, 1976 (in part). Order Orectolobiformes: Applegate, 1974, Chu & Wen, 1979. Suborder Plagiostomi Asterospondyli: Hasse, 1879 (in part). Suborder Scylliformes: Bertin, 1939 (in part). Suborder Scyllioidei: Goodrich, 1909 (in part). Suborder Squali: Gill, 1862 (in part).

Diagnostic Features : Trunk cylindrical to strongly depressed and somewhat raylike; head conical and slightly elevated to strongly depressed, not laterally expanded; 5 pairs of gill slits present on sides or on dorsolateral surface of head, the last two or more over the pectoral bases; spiracles present and small to very large, behind and below or at level of eyes; nostrils with barbels on the lateral surfaces of the anterior nasal flaps, strong nasoral grooves, and circumnarial grooves present or absent, connected to mouth, with anterior nasal flaps expanded posteriorly and reaching mouth; eyes lateral or dorsolateral on head, without true nictitating lower eyelids but sometimes with a subocular pocket below eyes; snout short to very short and bluntly rounded to truncated, not sawlike and without rostral barbels; mouth moderate to large, arched or virtually transverse and short, well in front of eyes; labial furrows very large, present on both jaws; teeth not strongly differentiated along jaws, without enlarged anterior or posterior teeth, and no small anterior teeth or a gap between anterior and lateral teeth in upper jaw; two dorsal fins, without spines, the first with its origin varying from over the pectoral fins to behind the pelvic fin bases but usually over or behind the pelvic bases; pectoral fins small to moderately large, not raylike and without triangular anterior lobes; pelvic fins moderately large, with vent usually continuous with their inner margins; anal fin present; caudal fin with a moderately long dorsal lobe but with ventral lobe varying from moderately long (but shorter than the dorsal lobe) to absent; vertebral axis raised into the dorsal caudal lobe; intestinal valve of spiral or ring type.

Page 166, para. 5, 'spirale' is 'spiral'. **Page 167**, para. 7, **page 168**, para. 10, **page 169**, para. 7, **page 170**, para. 5, Teng (1959) is Teng (1959a). **Page 173**, para. 14, **page 175**, para. 9, **page 177**, para 2, for 'perinasal' read 'circumnarial'. **Page 179**, para. 3, Compagno (1973) is (1973c), para. 4, Crossohrinus is Crossorhinus. **Page 192**, para. 9, underline griseum. **Page 203**, para. 3, 'pried lose' is 'pried loose'. **Page 206**, para. 7, 'brag' is 'drag'. **Page 207**, para. 9, "La Coquille2, omit 2, add ". **Page 209**, para. 10, 'Rhiodontidae' is 'Rhiniodontidae'. **Page 210**, para. 2, Hubbs, Iwai & Matsubara is Hubbs, Compagno & Follett. **Page 211**, para. 3, 'utilized' is 'utilize', para. 4, 'excited and hooked fishes' is 'excited by hooked fishes'. **Page 213**, para. 1, 'Teeth large, less numerous, and less than 50 rows in each jaw half' to 'Teeth usually larger, less numerous and less than 50 rows in each jaw half (except Cetorhinidae, with over 200)'; also, to 'Internal gill openings without rakers' add 'or with dermal denticle rakers'. **Page 216**, para. 1, White et al. (1962) is White, Tucker & Marshall (1961), 'odontstaspids' is odontaspids'; para. 7, 'absence of labial furrows' is 'presence of labial furrows'. **Page 218**, para. 5, 'sued' is 'used'. **Page 219**, para. 8, '*Carcharias ferox*. Placed on ... ' is '*Carcharias ferox* was placed on ...'. **Page 223**, para 7 and 224, para. 5, Uyeno (1976) is Uyeno, Nakamura & Mikami (1976). **Page 224**, para. 2, for 'teleost paddlefishes' read 'chondrostean paddlefishes'. **Page 230**, para. 7, Mizue *et al.* (1981) is Otake & Mizue (1981). **Page 232**, para. 2, and 246, para. 2, Gillmore (1983) is Gilmore (1983). **Page 234**, para. 1, 2 and 4, Rafinesque (1809) is Rafinesque (1810). **Page 237**, para. 2, Gray 1815 is Gray 1851. **Page 239**, para. 2, 'with light free rear tip' is 'without light free rear tip'. **Page 241**, para. 1, 'divers surfers,' is 'divers, surfers,', para. 2, '0.12' is '0.13', para. 3, 'heard' is 'horde', para. 9, Biegelow & Schroeder is Bigelow & Schroeder, Arnold (1971) is Arnold (1972). **Page 243**, para. 3, to 'teeth with incomplete cutting edges' add 'in young and small adults'. **Page 246**, para. 2, Fourmanoir & Laborde is Fourmanoir & Laboute; Dodrill & Gillmore is Dodrill & Gilmore, para. 3, Compagno (1978, 1981a) is Compagno & Vergara (1978), Compagno (1981a). **Page 248**, para. 1, Uquuhart is Urquhart. **Page 249**, para. 10, Stevens (1983) is Stevens, Dunning & Machida (1983).

Additions : Family Chlamydoselachidae: *Chlamydoselachus anguineus* was reported from off Surinam and French Guiana by Uyeno, Matsuura & Fujii (1983), the first western Atlantic record.

Family Squalidae: Papers by Yano & Tanaka (1983, 1984, 1984a) clarify the status of *Scymnodon* and *Centroscymnus* from the western Pacific. *Centroscymnus coelolepis* is reported from Japan, *Scymnodon obscurus* from the Atlantic is synonymized on good evidence with the Pacific *S. squamulosus*, and a new species, *S. ichiharai*, is described from Japan. *S. ichiharai* is undoubtedly valid but further bridges the gap between *Scymnodon* and *Centroscymnus*, and makes it likely that the two genera will have to be synonymized.

Family Hemiscylliidae: Dingerkus & DeFino (1983) present a comprehensive revision of this family, which must be briefly dealt with here. The species listed in the present account are recognized by these authors with the exception of *Chiloscyllium caerulopunctatum*, which is synonymized with *C. plagiosum*, and *C. arabicum*, which was apparently overlooked. They recognize an Indonesian species, *C. hasselti* Bleeker, 1852, formerly synonymized with *C. griseum*, and describe two new species, *C. burmensis* from Burma and *C. confusum* from the "Gulf" east to India. *C. hasselti* and *C. burmensis* appear to be valid, while *C. confusum* seems to be a junior synonym of *C. arabicum*.

Family Odontaspididae: Gilmore, Dodrill & Linley (1983) give a detailed and fascinating account of the reproduction of the sand tiger shark, *Eugomphodus taurus*, documenting the squence of intrauterine nourishment in this species, in which a successful embryo progresses from using stored yolk through killing and eating other embryos to eating unfertilized eggs, for a 9 to 12 month gestation period.

Family Mitsukurinidae: The goblin shark, *Mitsukurina owstoni*, was reported from off Surinam and French Guiana by Uyeno, Matsuura & Fujii (1983).

Family Cetorhinidae: Priede (1984) details a successful short-term satellite tracking effort on a radio-tagged basking shark, *Cetorhinus maximum*. This space-age methodology promises to reveal some of the secrets of the basking shark's seasonal migrations and movements.

Family Lamnidae: Pratt & Casey (1983) estimated the age of the shortfin mako, *Isurus oxyrinchus*, using four methods. As with Parker & Stott's (1965) work with the basking shark, *Cetorhinus maximus*, these authors assume two growth rings per year on mako vertebrae from indirect calibration methods.

11. LIST OF SPECIES BY MAJOR FISHING AREAS

(Map of Major Fishing Areas on page 592)

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																			
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																		
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
CHLAMYDOSELACHIDAE																					
Chlamydoselachus anguineus	14				●		●			●		●			●			●	●	●	
HEXANCHIDAE																					
Heptranchias perlo	17					●	●	●	●	●		●	●		●		●		●	●	
Hexanchus griseus	19				●	●	●	●	●	●		●	●		●	●	●	●	●	●	
Hexanchus vitulus	20					●	●					●	●		●						
Notorynchus cepedianus	22								●	●		●	●		●	●		●	●	●	
ECHINORHINIDAE																					
Echinorhinus brucus	26			●	●	●	●	●	●	●		●	●		●		●		●		
Echinorhinus cookei	27														●		●	●	●	●	
SQUALIDAE																					
Aculeola nigra	34																			●	
Centrophorus acus	36					●									●						

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																			
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																		
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Centrophorus granulosus	37				●	●	●	●				●			●						
Centrophorus harrissoni	38												●		?				●		
Centrophorus lusitanicus	39				●		●					●			●						
Centrophorus moluccensis	40											●	●		●		●				
Centrophorus niaukang	41														●						
Centrophorus squamosus	43				●		●			●		●			●		●		●		
Centrophorus tesselatus	44														●			●			
Centrophorus uyato	45					●	●	●		●	●	●			?						
Centroscyllium fabricii	47			●	●	?	●			●											
Centroscyllium granulatum	49								●												
Centroscyllium kamoharai	49														●						
Centroscyllium nigrum	50																	●		●	
Centroscyllium ornatum	51											●	●								
Centroscyllium ritteri	52														●						

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																		
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																	
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Centroscymnus coelolepis	55			●	●		●	●		●							?		?		
Centroscymnus crepidater	56				●		●			●		●							●	●	
Centroscymnus cryptacanthus	57						●		●												
Centroscymnus macracanthus	58								●												
Centroscymnus owstoni	59					●									●				●		
Centroscymnus plunketi	60																		●		
Cirrhigaleus barbifer	61														●		●		●		
Dalatias licha	63			●	●	●	●	●				●	●		●		●	●	●		
Deania calcea	65				●		●			●			●		●				●	●	
Deania histricosa	66						●								●						
Deania profundorum	67					●	●			●		●					●				
Deania quadrispinosum	68									●		●	●						●		
Etmopterus baxteri	71																		●		
Etmopterus brachyurus	72																●				

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																			
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																		
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Etmopterus bullisi	74					●															
Etmopterus decacuspidatus	75														●						
Etmopterus gracilispinis	76			●		●			●	●											
Etmopterus granulosus	77								●	●										●	
Etmopterus hillianus	78			●		●															
Etmopterus lucifer	79								●	?		●	●		●		●		●		
Etmopterus polli	80					●	●														
Etmopterus princeps	81			●	●		●								?		?				
Etmopterus pusillus	82				●	●	●		●	●		●			●						
Etmopterus schultzi	83					●															
Etmopterus sentosus	84											●									
Etmopterus spinax	85				●		●	●		●											
Etmopterus unicolor	86														●						
Etmopterus villosus	87																	●			

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																			
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																		
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Etmopterus virens	88					●															
Euprotomicroides zantedeschia	89								●	●											
Euprotomicrus bispinatus	90								●	●		●	●		●			●	●	●	
Heteroscymnoides marleyi	92						●					●									
Isistius brasiliensis	93					●	●		●	●		●	●		●	?	●	●		●	
Isistius plutodus	95					●									●						
Scymnodalatias sherwoodi	97																		●		
Scymnodon obscurus	98				●	●	●		●			?									
Scymnodon ringens	99				●		●														
Scymnodon squamulosus	101														●		?		●		
Somniosus microcephalus	103		?	●	●					●				●					?		
Somniosus pacificus	105		●												●	●		●			
Somniosus rostratus	106				●		●								●						
Squaliolus laticaudus	108				●	●	●		●			●			●		●				

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																			
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																		
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Squalus acanthias	111			●	●	●	●	●	●	●			●		●	●	?	●	●	●	
Squalus asper	114					●						●						●			
Squalus blainvillei	115				●		●	●		●					●						
Squalus cubensis	116					●			●												
Squalus japonicus	117														●		●				
Squalus megalops	118						●			●		●	●		●		●		●		
Squalus melanurus	120																●				
Squalus mitsukurii	121					?	?		?			●	●		●		●	●	●	?	
Squalus rancureli	122																●				
OXYNOTIDAE																					
Oxynotus bruniensis	125												●						●		
Oxynotus caribbaeus	126					●															
Oxynotus centrina	127				●		●	●		?											
Oxynotus paradoxus	128				●		●														

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																			
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																		
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
PRISTIOPHORIDAE																					
Pliotrema warreni	132									●		●									
Pristiophorus cirratus	133												●				?		●		
Pristiophorus japonicus	134														●		?				
Pristiophorus nudipinnis	135												●						●		
Pristiophorus schroederi	136					●															
SQUATINIDAE																					
Squatina aculeata	140						●	●		●											
Squatina africana	141											●									
Squatina argentina	142								●												
Squatina australis	143												●						●		
Squatina californica	144															●		●		●	
Squatina dumeril	145				●		●														
Squatina formosa	146														●						

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																			
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																		
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Squatina japonica	147														●		?				
Squatina nebulosa	148														●						
Squatina oculata	149						●	●		●											
Squatina squatina	150				●		●	●													
Squatina tergocellata	151												●						●		
Squatina tergocellatoides	152														●						
HETERODONTIDAE																					
Heterodontus francisci	156																	●		?	
Heterodontus galeatus	157												?				●		●		
Heterodontus japonicus	158														●						
Heterodontus mexicanus	159																	●		●	
Heterodontus portusjacksoni	160												●				●		●		
Heterodontus quoyi	162																	●		●	
Heterodontus ramalheira	163										●										

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																			
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																		
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Heterodontus zebra	164												●		●		●				
PARASCYLLIDAE																					
Cirroscyllium expolitum	168																●				
Cirroscyllium formosanum	168														●						
Cirroscyllium japonicum	169														●						
Parascyllium collare	170												●						●		
Parascyllium ferrugineum	171												●								
Parascyllium multimaculatum	172												●								
Parascyllium variolatum	173												●								
BRACHAELURIDAE																					
Brachaelurus waddi	175												●				●				
Heteroscyllium colcloughi	176																●				
ORECTOLOBIDAE																					
Eucrossorhinus dasypogon	179												●				●				

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																		
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																	
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Orectolobus japonicus	181														●		●				
Orectolobus maculatus	182												●		●		●		●		
Orectolobus ornatus	184												●		●		●		●		
Orectolobus wardi	185												●				●				
Sutorectus tentaculatus	187												●								
HEMISCYLLIIDAE																					
Chiloscyllium arabicum	190											●									
Chiloscyllium caerulopunctatum	190											●									
Chiloscyllium griseum	191											●	●		●		●				
Chiloscyllium indicum	193											●	●		●		●				
Chiloscyllium plagiosum	194											●	●		●		●				
Chiloscyllium punctatum	194												●		●		●				
Hemiscyllium freycineti	196																●				
Hemiscyllium hallstromi	197																●				

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																			
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																		
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Hemiscyllium ocellatum	197												●				●				
Hemiscyllium strahani	198																●				
Hemiscyllium trispeculare	199												●				●				
STEGOSTOMATIDAE																					
Stegostoma fasciatum	200											●	●		●		●		?		
GINGLYMOSTOMATIDAE																					
Ginglymostoma brevicaudatum	204											●									
Ginglymostoma cirratum	205			●	●	●	●		●	?								●		●	
Nebrius ferrugineus	207											●	●		●			●			
RHYNIODONTIDAE																					
Rhiniodon typus	210			●		●	●		●	●		●	●		●		●	●		●	
ODONTASPIDIDAE																					
Eugomphodus taurus	216			●		●	●	●	●	●		●	●		●		●		●		
Eugomphodus tricuspidatus	218											●	●				?				

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																		
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																	
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Odontaspis ferox	219				●		●	●				●			●			●	●		
Odontaspis noronhai	221						●		●			?									
MITSUKURINIDAE																					
Mitsukurina owstoni	223				●	●	●			●		●	●		●				●		
PSEUDOCARCHARIIDAE																					
Pseudocarcharias kamoharai	225						●			●		●	●		●		?	●			
MEGACHASMIDAE																					
Megachasma pelagios	227																	●			
ALOPIIDAE																					
Alopias pelagicus	229											●	●		●		●	●			
Alopias superciliosus	231			●	●	●	●	●	●	●		●	●		●		●	●	●		
Alopias vulpinus	232			●	●	●	●	●	●	●		●	●		●	●	●	●	●	●	
CETORHINIDAE																					
Cetorhinus maximus	234			●	●	●	●	●	●	●			●		●	●		●	●	●	

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																			
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																		
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
LAMNIDAE																					
Carcharodon carcharias	238			●	●	●	●	●	●	●		●	●		●	●	●	●	●	●	
Isurus oxyrinchus	242			●	●	●	●	●	●	●		●	●		●	●	●	●	●	●	
Isurus paucus	244			●		●	●					●	?				●	●			
Lamna ditropis	246														●	●		●			
Lamna nasus	247			●	●	●	●	●	●	●		●	●						●	●	
SCYLIORHINIDAE																					
Apristurus atlanticus	261						●														
Apristurus brunneus	262															●		●		?	
Apristurus canutus	263					●															
Apristurus herklotsi	264																●				
Apristurus indicus	265									?		●									
Apristurus investigatoris	267												●								
Apristurus japonicus	268														●						

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																			
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																		
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Apristurus kampae	269																	●			
Apristurus laurussoni	270			●	●	●	●														
Apristurus longicephalus	271														●						
Apristurus macrorhynchus	272														●						
Apristurus maderensis	272				?		●														
Apristurus manis	273			●	●		?														
Apristurus microps	275			?	?					●											
Apristurus nasutus	276						?											●		●	
Apristurus parvipinnis	277					●															
Apristurus platyrhynchus	278														●						
Apristurus profundorum	279			●			?														
Apristurus riveri	280					●															
Apristurus saldanha	282									●											
Apristurus sibogae	283																●				

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																			
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																		
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Apristurus sinensis	284														●		●				
Apristurus spongiceps	285																●	●			
Apristurus stenseni	286																	●			
Apristurus verweyi	287																●				
Asymbolus analis	290												●						●		
Asymbolus vincenti	291												●						●		
Atelomycterus macleayi	292												●				●				
Atelomycterus marmoratus	293											●	●		●		●				
Aulohalaelurus labiosus	295												●								
Cephaloscyllium fasciatum	297												●		●			●			
Cephaloscyllium isabellum	298														●				●		
Cephaloscyllium laticeps	299												●						●		
Cephaloscyllium nascione	300												●						●		
Cephaloscyllium silasi	301											●									

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																			
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																		
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Cephaloscyllium sufflans	302											●									
Cephaloscyllium ventriosum	303																	●		●	
Cephalurus cephalus	305																	●			
Galeus arae	308					●															
Galeus boardmani	310												●						●		
Galeus eastmani	311														●		●				
Galeus melastomus	312				●		●	●													
Galeus murinus	313				●																
Galeus nipponensis	314														●						
Galeus piperatus	315																	●			
Galeus polli	316						●			●											
Galeus sauteri	317														●		?				
Galeus schultzi	318																●				
Halaelurus alcocki	321											●									

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																		
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																	
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Halaelurus boesemani	321											●	●		●		●				
Halaelurus buergeri	322														●						
Halaelurus canescens	323																			●	
Halaelurus dawsoni	324																		●		
Halaelurus hispidus	325											●	●								
Halaelurus immaculatus	326														●						
Halaelurus lineatus	327											●									
Halaelurus lutarius	329											●									
Halaelurus natalensis	330									●		●									
Halaelurus quagga	331											●									
Haploblepharus edwardsii	332									●		●									
Haploblepharus fuscus	334									●		●									
Haploblepharus pictus	335									●											
Holohalaelurus punctatus	336									●		●									

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																		
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																	
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Holohalaelurus regani	338									●		●									
Parmaturus campechiensis	341					●															
Parmaturus melanobranchus	341														●		●				
Parmaturus pilosus	343														●						
Parmaturus xaniurus	344																	●			
Pentanchus profundicolus	345																●				
Poroderma africanum	347									●		●									
Poroderma marleyi	348									●		●									
Poroderma pantherinum	349									●		●									
Schroederichthys bivius	352								●											●	
Schroederichthys chilensis	352																			●	
Schroederichthys maculatus	353					●															
Schroederichthys tenuis	354					●															
Scyliorhinus besnardi	357								●												

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																			
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																		
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Scyliorhinus boa	357					●															
Scyliorhinus canicula	358				●		●	●													
Scyliorhinus capensis	359									●		●									
Scyliorhinus cervigoni	361						●			●											
Scyliorhinus garmani	362												●				●				
Scyliorhinus haeckeli	362					●			●												
Scyliorhinus hesperius	363					●															
Scyliorhinus meadi	364					●															
Scyliorhinus retifer	365			●		●															
Scyliorhinus stellaris	366				●		●	●													
Scyliorhinus torazame	367														●		●				
Scyliorhinus torrei	368					●															
PROSCYLLIIDAE																					
Ctenacis fehlmanni	371											●									

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																			
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																		
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Eridacnis barbouri	372					●															
Eridacnis radcliffei	373											●	●		●		●				
Eridacnis sinuans	374											●									
Gollum attenuatus	375																		●		
Proscyllium habereri	377														●		●				
PSEUDOTRIAKIDAE																					
Pseudotriakis microdon	378			●	●		●					●			●		●	●			
LEPTOCHARIIDAE																					
Leptocharias smithii	380						●	?		●											
TRIAKIDAE																					
Furgaleus macki	385												●								
Galeorhinus galeus	386				●		●	●	●	●			●			●	●	●	●	●	
Gogolia filewoodi	389																●				
Hemitriakis japanica	391														●		?				

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																			
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																		
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Hemitriakis leucoperiptera	392																●				
Hypogaleus hyugaensis	394											●			●						
Iago garricki	395																●				
Iago omanensis	396											●									
Mustelus antarcticus	401												●				●		●		
Mustelus asterias	402				●		●	●													
Mustelus californicus	403																	●			
Mustelus canis	404	?		●		●			●												
Mustelus dorsalis	407																	●		●	
Mustelus fasciatus	408								●												
Mustelus griseus	409														●		●				
Mustelus henlei	410																	●		●	
Mustelus higmani	412					●			●												
Mustelus lenticulatus	413																		●		

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																			
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																		
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Mustelus lunulatus	414																	●			
Mustelus manazo	416											●	?		●		●				
Mustelus mento	417								●											●	
Mustelus mosis	418											●	●								
Mustelus mustelus	419				●		●	●		●											
Mustelus norrisi	421					●			●												
Mustelus palumbes	422									●		●									
Mustelus punctulatus	423						●	●													
Mustelus schmitti	424								●												
Mustelus whitneyi	425																			●	
Scylliogaleus quecketti	427									●		●									
Triakis acutipinna	428																			●	
Triakis maculata	429																			●	
Triakis megalopterus	430									●		?									

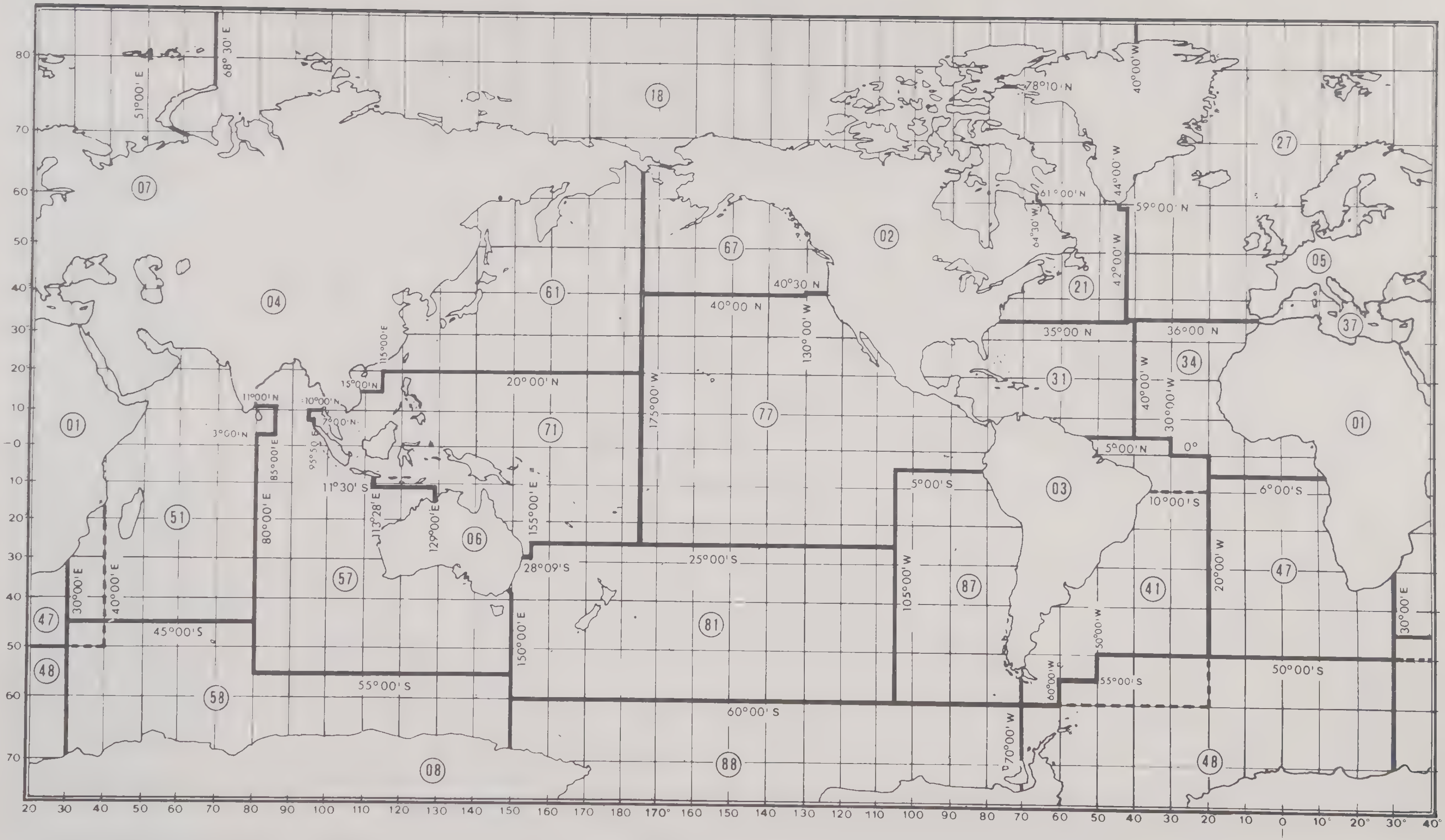
SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																			
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																		
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Triakis scyllium	432														●		?				
Triakis semifasciata	433																	●			
HEMIGALEIDAE																					
Chaenogaleus macrostoma	437											●	●		●		●				
Hemigaleus microstoma	439											●	●		●		●				
Hemipristis elongatus	440									●		●	●		●		●				
Paragaleus pectoralis	442			?			●			●											
Paragaleus tengi	444											●					●				
CARCHARHINIDAE																					
Carcharhinus acronotus	454					●			●												
Carcharhinus albimarginatus	455					?						●			●		●	●		●	
Carcharhinus altimus	457					●	●					●			●			●		●	
Carcharhinus amblyrhynchoides	458											●	●		●		●				
Carcharhinus amblyrhynchos	459											●	●		●		●	●	●		

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																			
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																		
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Carcharhinus amboinensis	461						●					●	●				●		●		
Carcharhinus borneensis	463												●		●		●				
Carcharhinus brachyurus	464					●	●	●	●	●		●	●		●		●	●	●	●	
Carcharhinus brevipinna	466			●		●	●	●	●	●		●	●		●		●		●		
Carcharhinus cautus	468												●				●				
Carcharhinus dussumieri	469											●	●		●		●				
Carcharhinus falciformis	470			●		●	●		●			●	?		●		●	●	●	●	
Carcharhinus fitzroyensis	472												●				●				
Carcharhinus galapagensis	473				?	●	●			●		●					●	●	●	●	
Carcharhinus hemiodon	475	?										●	●		●		●				
Carcharhinus isodon	477			●		●	?		●												
Carcharhinus leucas	478	●		●		●	●		●	●		●	●		●		●	●	●	●	
Carcharhinus limbatus	481			●		●	●	●	●			●	●		●		●	●		●	
Carcharhinus longimanus	484			●	●	●	●	?	●			●	●		●		●	●	●	●	

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																			
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																		
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Carcharhinus macloti	486											●	●		●		●				
Carcharhinus melanopterus	487	?						●				●	●		●		●	●	●		
Carcharhinus obscurus	489			●		●	●		●	●		●	●		●		●	●	●	?	
Carcharhinus perezi	492					●			●												
Carcharhinus plumbeus	493			●	●	●	●	●	●	●		●	●		●		●	●		?	
Carcharhinus porosus	496					●			●									●		●	
Carcharhinus sealei	497											●	●		●		●				
Carcharhinus signatus	499			●		●	●		●	●								●			
Carcharhinus sorrah	500											●	●		●		●		●		
Carcharhinus wheeleri	501											●									
Galeocerdo cuvier	503			●	●	●	●		●			●	●		●		●	●	●	●	
Glyphis gangeticus	507	●										●	●								
Glyphis glyphis	509	?															●				
Isogomphodon oxyrhynchus	510					●			●												

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																			
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																		
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Lamiopsis temmincki	512											●	●		●		●				
Loxodon macrorhinus	514											●	●		●		●				
Nasolamia velox	515																	●		●	
Negaprion acutidens	517											●	●				●	●			
Negaprion brevirostris	519	?		●		●	●		●									●		●	
Prionace glauca	521			●	●	●	●	●	●	●		●	●		●	●	●	●	●	●	
Rhizoprionodon acutus	525						●			●		●	●		●		●				
Rhizoprionodon lalandii	527					●			●												
Rhizoprionodon longurio	528																	●		●	
Rhizoprionodon oligolinx	529											●	●		●		●				
Rhizoprionodon porosus	530					●			●												
Rhizoprionodon taylori	531												●				●				
Rhizoprionodon terraenovae	532			●		●															
Scoliodon laticaudus	534	?										●	●		●		●				

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																			
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																		
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Triaenodon obesus	536											●	●		●		●	●		●	
SPHYRNIDAE																					
Eurphyra blochii	540											●	●		●		●				
Sphyrna corona	543																	●		●	
Sphyrna couardi	544						●	●													
Sphyrna lewini	545			●		●			●			●	●		●		●	●		●	
Sphyrna media	547					●			●									●		●	
Sphyrna mokarran	548					●	●	●	●	●		●	●		●		●	●	●	●	
Sphyrna tiburo	550			●		●			●									●		●	
Sphyrna tudes	551					●			●												
Sphyrna zygaena	553			●	●	●	●	●	●	●		●	●					●	●	●	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Major Fishing Areas for statistical purposes .

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13. INDEX OF SCIENTIFIC AND VERNACULAR NAMES

EXPLANATION OF THE SYSTEM

The index applies exclusively to Chapter 2 through 9, pertaining to information by species

Type faces used:

Italics : Valid scientific names (genera and species)
: Synonyms (preceded by an asterisc)

ROMAN (caps) : Family Names

Roman : International (FAO) species names
: Local names (preceded by an asterisk)

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